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THE STREET RAILWAY CONVENTION.

It is pleasant to record the success of the convention of the American Street Railway Association just concluded at Kansas City, Mo., and highly instructive to look back over the history of this body and the quality of its meetings. It was not so very long ago that the horse car was the only representative of street traction, and when the programmes of the association meetings dealt almost altogether with the care of horses and horse equipment. About fourteen years ago came whisperings of electrical equipment and for the next ten years the association meetings were almost as technical as those of the American Institute of Electrical Engineers. Many papers of high importance and great value were first presented at its sessions, and up to about four years ago these meetings were almost purely electrical engineering gatherings wherein the problems discussed were practically confined to those involved in the substitution of electric for horse traction and in the growth in magnitude and importance of electric traction lines. The electric street railway, however, has rapidly tended toward that standardization that marks so many features of enterprise in this country. To discuss new methods and new applications is no longer so important as to bring out new ways and better ways of utilizing the present standard equipment in the legitimate business of the street railway manager. This business is simply and solely a question of how to transport the most passengers in the quickest time and under the safest and best conditions for the least amount of money, hence the standardization of railway apparatus has led to the disappearance of deeply technical papers from the association programmes and in place the substitution of articles more directly concerning the actual business in hand—that of capturing the elusive nickel.

On account of the deep and abiding interest of street railway people in electrical equipment, the custom was inaugurated some years ago of exhibiting at each convention some appliances and apparatus and this grew until nowadays a full-size electrical exposition is held each year in connection with the association's convention. The exhibits at Kansas City this year were particularly good and extensive, and the supply men were, of course, on hand in full force. From all accounts, no little business was done, and everybody seems to have had a good time. In this connection it should be said that Kansas City endeared itself to its guests. The hospitality extended by the city and the witty and delightful address of welcome made by its Mayor will long be remembered as among the pleasantest instances that have marked recent conventions of the association.

THE UBIQUITOUS TELEPHONE.

It has been announced by the Pacific Coast Telephone Company that is proposes to put a telephone in every house, whether it be a mansion in the city or a farmhouse far distant from its neighbors, in the vast tract of country that its lines embrace. In other words, it is proposed to make the telephone practically universal in that region and to bring all of its citizens into instantaneous touch with one another. It is sincerely to be hoped that the company will succeed in this laudable endeavor, and that California and its neighbors may be the field of an extraordinary success in the development of the telephone. While it is easy to grant the vital importance of the telephone in modern business affairs, one can not help feeling that, even to-day, this instrument has been denied an opportunity to prove its highest usefulness. There seems to be no physical reason why the telephone should not be as universal as the water-main and the gas-pipe. This alluring subject is liable to lead one afar if he stops to think about the conditions of civilization that would exist were every place of business and every habitation furnished with telephones able to connect with all other telephones. The necessity for taking journeys would practically cease and the passenger business of railroads and steamship lines would be confined to those who travel for pleasure or for the more intimate meeting of their acquaintances and correspondents. The business of the world would be done over the wire and not by personal interview or through the mails. Even the five o'clock tea and the social call would be-

come things as far in the remote past as the sedan chair and the hoopskirt. Possibly even the newspaper would find its field diminished, while the solidarity of nations would increase and international boundaries might practically be wiped out by the freedom of intercourse that would be brought about by this overmastering application of electricity.

No one intimately familiar with the telephone and its development can doubt that all this is not only possible but even exceedingly probable. Within the last two or three years the telephone has been developing along just such lines as indicated above, and those of us who have not passed the middle period of age may yet hope to live to see some such widespread use of this instrument as is here suggested. And the indication, which any man may perceive for himself, is practically useless, because one can never look ahead and see where the development of such a utility will end. No man foresaw in the increase of telegraph lines the establishment of a National Weather Bureau, yet this was a direct outcome of the possibility of instantaneous collection of intelligence from scattered points. It will be the same with the telephone when a broader and a wiser business policy or the slow-acting logic of events brings about the universal equipment of dwellings, workshops and offices with telephones. We may all reasonably expect to see as a result conditions and benefits undreamed of to-day.

ELECTRICAL DEVELOPMENT IN THE FAR EAST.

Mysticism, fanaticism and intolerance, the arch-enemies of progress and civilization, the moulders of national destiny in the Levant, and the dam to prosperity, have been the main features of the stolid obstinacy with which the semi-barbarian has resisted modern enterprise. The decree of an all-wise Providence has ordained, however, that in the swing of time the survival of the fittest is the doctrine which shall move the world; weakness and incapability must disappear slowly, giving place to the power of methodical and organized effort.

Many of us can remember the news of Commodore Perry's achievement in opening Chinese ports to American trade, and ever since then the advance of commerce and ingenuity has been steadily forging ahead far more rapidly than the most sanguine optimist dared hope when the movement began.

The development of the Mohammedan countries in the Far East has been attended with great danger and difficulty in nearly every line of work, but particularly in electrical matters, so it is not surprising that, until the present year, no appreciable progress has been made. A vague combination of faith in the doctrines of Mohammed and a semi-conscious altruism has been the mainstay of this resistance, backed up and enhanced by the cringing terror of the respective monarchs lest the assassin or traitor should, by means of the strange devices—so uncouth and awe-inspiring in oriental eyes—conceal some occult means of stirring up the smouldering fires of treason and mutiny, or sending, undesired, the soul of the believer whence it can not return to warn its brothers.

Some years ago, easily within the memory of the present generation, an English manufacturer sent some complex machinery to the port of Constantinople, in the Ottoman Empire. In the packages containing the shipment were the customary instruction sheets for setting up the machines, and on one of them was the statement: "Great care must be exercised in keeping the boilers well cleaned, etc." the pamphlet ending with a warning against explosions due to carelessness. "Seditious! Vile treason! Destroy them at once!" said the Turkish customs officer who was inspecting the apparatus. On another occasion a hundred or more English bibles, consigned to a prominent missionary, were passed through the customs, and seized in the house of the unfortunate clergyman, who was subjected to great annoyance and threatened with imprisonment for importing treasonable propoganda. It is perfectly patent from the foregoing and countless similar incidents too numerous to relate that until some definite civilizing power could obtain a foothold in such countries the importation of mechanical or electrical appliances was not to be seriously considered.

Within the past few months there has been a very marked improvement in the Eastern situation, which proves the efficacy of electricity as a civilizer. The Sultans of Turkey and the Indian principality of Johore, which is the southernmost state in the Malay Peninsula, have bought electrical apparatus. Prior to this the Turkish officers might not pass any sort of electric appliances, but the Sublime Porte has now issued an irade permitting the importation of small machines and appliances, while the Indian potentate has ordered a complete plant and machinery at a cost of over half a million.

This may surely be regarded as a sign of the progress that is being made and when once the tremendous advantages that the "chained lightning" inevitably brings draw the attention of the people who now rely on oil, the courier and a rather doubtful postal system, it will be a question of a short time only when those nations take up the work and enroll themselves among the live powers of the greatest age of improvements the world has ever known.

It is curious how one discovery in science almost invariably leads to a series of others which tend to connect disjointed and isolated phenomena. When Sir William Crookes, some twenty years ago, made the famous series of experiments which led him to speculate upon a fourth state of matter, he did work which lay fallow for long years, to be used later as the basis of the superb series of researches lately conducted by Rœntgen, Becquerel, the two Curies and J. J. Thomson. The latter has built upon the experiments that showed new kinds of radiation and new forms of transfer of matter in vacuous space perhaps the most astonishing hypothesis that has appeared during the century. His work has connected the researches of men groping into the unknown beyond the frontier of physical and chemical science, and has gone a long way toward clearing some of the fundamental mysteries such as the nature of matter and the nature of electricity. And beyond this, it may be remarked that only a few years ago electricity was a small branch of physics; today the subject practically includes all physics, and may even yet lead us to understand gravitation and other actions apparently totally disconnected with it.

Science Brevities

The Conductivity of Telegraph Cables—The following curious paragraph is taken from the London *Electrical Engineer*. There has been some question as to the reason why certain cables lose their conducting properties, and have, in some instances, to be replaced. Mr. Rheims has been endeavoring to find out the reason for this, and in consequence has submitted a paper on the subject to the Académie des Sciences. In this paper he states that when cables lose their electrical properties it is because they are always used for one kind of current only, either positive or negative. If used sometimes for positive and sometimes for negative, they will, he states, preserve their conductive qualities indefinitely. He illustrates this by an observation on an undeground line between Paris and Dijon, the line having nine wires. Of these, wire No. 7 received alternately positive and negative currents. This line kept its conducting properties, while the eight other wires, which were used with Morse and Hughes instruments and only received positive currents, had all lost more or less of their conductivity. The remedy for this loss was stated to be obvious—namely, that all currents sent in one direction should be positive, those in the contrary direction being negative, thus destroying the action of the first current by that of the second.

A Heated Insulator—Mr. A. Sinding Larsen, of Frederiksvaern, Norway, has projected a new form of high-voltage insulator designed with the object of getting over the condensation trouble. It is known that when very high voltages are used on overhead lines, it is not always possible to prevent a considerable amount of leakage which is due to the condensation of moisture on the surface of the porcelain or glass insulators. Mr. Larsen proposes to prevent this condensation by maintaining one portion of the insulator at a higher temperature than the air. This increase of temperature need be exceedingly small, and the author states that one degree centigrade is quite sufficient to prevent the moisture in the air condensing on one part of the insulator, as it will always choose the colder portion on which to be deposited. In order to obtain the heat at one portion of the insulator, a resistance coil is inserted into a cylindrical recess which is formed in the porcelain. This resistance wire can either be supplied with a current by means of an independent circuit, or when the main current, passing along the high-voltage conductors is alternating, the heating current can be obtained by a small local circuit energized by induction. Of course, the energy required is quite small, so that it hardly enters into consideration when a large amount of power is being transmitted, says a British contemporary.

Resistance of Bismuth—Herr W. Eichhorn has carried out some interesting investigations of the speed with which bismuth assumes a certain resistance under the influence of a magnetic field. Mr. Fournier d'Albe thus abstracts his results: He mounted a bismuth coil on a revolving disk so that at a certain point it passed through a magnetic field. Its instantaneous resistance was measured by means of contact pieces attached to the disk, and the resistances shown at various points when entering or leaving the field were compared with the resistances shown at the same points in a state of rest. Any lag or hysteresis of the resistance would then show itself as a difference of resistance for corresponding points, according to the state of rest or motion. The rate of revolution was 1,000 per minute. A well-marked difference was observed, both on entering and leaving the field. On leaving the field the resistance remained too high. This result is specially conclusive. For in the state of rest the resistance was influenced by the heat of the magnetizing current, which tended to exaggerate the normal resistance. That the resistance when in motion is still greater shows that the bismuth does not instantaneously lose the high resistance acquired in the maximum field. The difference is constant for any speed of revolution exceeding 500 per minute, but below that rate it increases with the speed. The author calls the phenomenon a viscous hysteresis of resistance.

Becquerel Rays—The subject of Becquerel rays has been much discussed recently, and Mr. Oscar M. Stewart has though fit to bring up to date, in the *Physical Review*, a résumé of the matter given in that journal some two years ago. In the present résumé he speaks of the substances, in addition to uranium, which have been found to emit these radiations. He goes on to deal with the fluorescence and phosphorence of these rays, their relation to the conductivity of gases, the absorption of the rays, their chemical effects, their secondary or induced activity, the thorium radiations, and the magnetic and electrostatic effects of the rays. The résumé is too long to describe with more detail, but the theories given concerning the origin of the Becquerel radiation are of great interest, says the *Electrical Engineer*. Thus the author states that many theories have been suggested concerning them. Madame Curie first suggested that the energy may be due to a very penetrating radiation hitherto unknown, which would excite fluorescence in some substances. Sir William Crookes suggested to the British Association in 1898 that in some way the energy might be obtained from the rapidly moving air particles. Messrs. Elster and Geitel took a salt of uranium into a deep mine, where it was protected by 2,785 feet of earth from external radiations, and the salt was still active. When kept in a high vacuum the radiations were still emitted the energy thus not being due to a mechanical or chemical action of the air. The impact of X-rays or cathode rays was also found to produce no change in the radiation. Messrs. Elster and Geitel suggested that the energy may come from an unstable molecule gradually passing over into a stable state, this idea being also supported by Behrendsen. Until the discovery of the magnetic deflection of Becquerel rays, it was thought that they were X-rays of feeble intensity. As the rays belonging to the deflectable group carry negative charges, they probably consist of small particles of matter, as matter and electrical charges are, as far as is known, inseparable. According to the theory used to explain the Zeeman effect, each molecule has revolving around it at a high speed one or more small satellites negatively charged. Measurements based on this theory have shown that the ratio of charge to the mass of a satellite is of the same order of magnitude as that obtained for the cathode ray particle or for the deflectable Becquerel rays. In the molecular groupings of the radio-active elements they may, the author thinks, the conditions of instability such that some of these satellites could be lost from their molecules, and moving off at high speed become the deflectable Becquerel rays. The theory that Becquerel rays consist of extremely short ultra-violet rays is now almost abandoned, and it is believed that they, like the cathode rays, are negatively-charged particles of matter moving at extremely high velocity. Professor J. J. Thomson has shown that the ratio of charge to mass for the negatively-charged particles in gases at low pressures is a constant, and if this is true, it is the velocity which varies. The difference in penetration is then explained by a greater velocity for the Becquerel ray particle—the greater the velocity the higher being the value in the cathode rays.

THE ELECTRIC AND HYDRAULIC POWER PLANT OF THE SAINT LAWRENCE POWER COMPANY, MASSENA, N. Y.

A Description of the Engineering and Construction Features of the Greatest Electrical Power Plant in the World—Canals, Turbines and Other Hydraulic Features on a Gigantic Scale—Apparatus and Auxiliaries Necessary in Cutting a Great Canal—The Concrete Power House—Enormous Development of Hydraulic Power for Electrical Transmission and Utilization.

BY CHARLES T. CHILD.

On the New York side of the St. Lawrence River, near the town of Massena, a curious configuration of the country makes the Grasse River and the Racquette River flow parallel with the main stream of the St. Lawrence, to which they are tributary, the intervening country consisting of parallel ridges or elevations of small height and great regularity of formation. At a point about opposite the town of Massena begins a long series of rapids known as the Long Sault Rapids, which flow for several miles northward and eastward along the two sides of an island which here divides the stream into two practically equal parts. At the head of the rapids in the St. Lawrence the level of that river is about 42 feet higher than that of its tributary river, the Grasse, at its nearest point, this difference being overcome in the long rapids leading to the still water into which the Grasse River discharges.

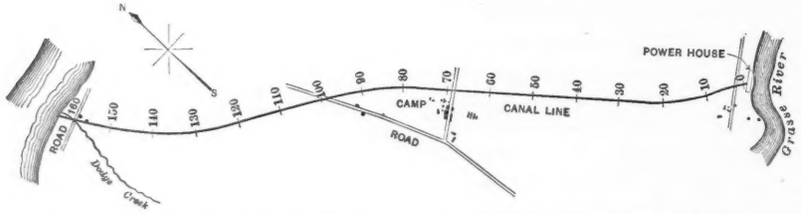


FIG. 1.—MAP SHOWING COURSE OF THE ST. LAWRENCE POWER COMPANY'S CANAL.

Curiously enough this difference of level was not suspected or considered by engineers until very recently, although the country has been inhabited for more than two centuries, and Massena Springs, which lies upon the Racquette River, has long been famous as a watering place. When this idea did suggest itself, immediately a plan for diverting a large portion of the waters of the St. Lawrence by means of a canal built across the intervening country to the Grasse River, where a fall of considerable height could be secured, that river acting as the tail race, was outlined, and a company was formed to carry into execution a plan comprising the development of a large water power and its utilization. This was to form a source of electric power which would be distributed to manufacturers in the neighborhood and utilized in all of the many ways in which it is possible to put such an agency to work. The power development is under construction by the St. Lawrence Power Company, of London, and no small portion of the capital employed upon the work is of British origin. The actual work of construction is in the hands of a construction company, bearing about the same relation to the power company as the Cataract Construction Company bore to the Niagara Falls Power Company. The T. A. Gillespie Company, of New York city, is the contractor having in hand most of the actual work of excavation and building.

The canal is very nearly straight and from the intake on the St. Lawrence River to the power house is 16,200 feet, or a little more than three miles, long. The canal might well have been constructed in a perfectly straight line but was curved somewhat to avoid inequalities of the ground and in order to pass at right angles to the line of some of the long wave-like elevations that it traverses.

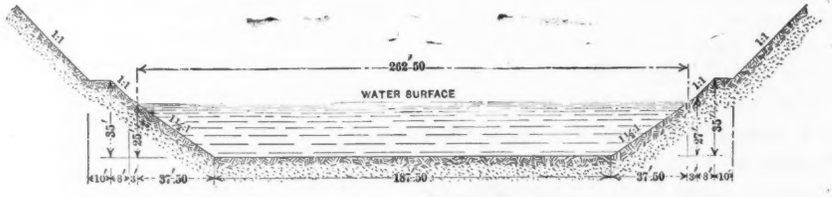


FIG. 2.—CROSS-SECTION OF THE ST. LAWRENCE POWER COMPANY'S CANAL.

In one of the illustrations a normal section of the canal as it is to be finished is shown. The excavation is to be 187½ feet wide at the base, 262½ feet wide at the water level, the water being 27 feet deep, and the slope of the banks 1½ to 1. At present about 4,700,000 cubic yards of material have been excavated and the present average bottom width is 140 feet with a width of 192 feet at the water line. The deepest cutting in the district, known as Andrews Ridge, is about 95 feet. The gradient of the canal is 6¾ feet per 1,000, giving an average velocity of flow of about 13½ miles per hour of the water. At the power house the available head is 32 feet, the canal at this point being somewhat enlarged to make a forebay or basin.

A variety of methods of excavation have been adopted on this work, among them being power scrapers, team scrapers and graders, hydraulic dredges and steam shovels. The materials that were encountered in the construction of the canal were of a nature rendering steam-shovel work very difficult. A considerable portion of the length of the canal passes through a bluish clay which is just sufficiently water-soaked to be stiff and sticky to the operation of the shovels and to hold together tenaciously so that it is very difficult to loosen it by blasting in pieces of proper size to handle comfortably. In this material the hydraulic dredges, which are well shown in the accompanying illustrations, were put to work with no little success. Curiously enough, in the whole course of the canal no rock was encountered except directly at the power house site, where naturally it was desired for foundations. Some of the dredges are what is known as the "orange peel" type, on account of the peculiar shape of the bucket employed, and others, which are illustrated on another page, are of the same type as those which have given such excellent satisfaction on the Chicago Drainage Canal, on the Pacific coast, and elsewhere. These machines consist of a hull 65 feet long, 30 feet wide and 6 feet deep. At the front in a frame carrying a ladder and supporting the auger, and the section pipe and on the rear are two "spuds," upon which or either of which the dredge swings while it is at work, or, as the workmen say, "walks up the canal." These dredges work somewhat like a gigantic corkscrew, a 12-inch suction pipe removing the materials broken up by the excavating head. To operate them a 12-

Fig. 3.—Discharge Pipe of Hydraulic Dredge.
Fig. 4.—Front View of an Hydraulic Dredge.
Fig. 5.—Bucket Dredge Working in Clay.
Fig. 6.—One of the Curves in the Canal.
Fig. 7.—One of the Big Steam Shovels.
Fig. 8.—Steam Shovels Working in Andrew's Ridge Cut.

VIEWS OF CONSTRUCTION WORK ON THE MASSENA POWER CANAL.

inch centrifugal pump is installed on board, direct-coupled to a 125-horse-power, compound, condensing engine. This pump is designed to work against a total lift of as much as 60 feet, and it is stated that a vacuum as good as 25 inches of mercury can be maintained by it in the suction pipe. The pressure on the discharge pipe runs up at times to 25 pounds per square inch. In addition to this pump machinery a hoisting engine is carried on the forward end of the dredge and all of the machinery is controlled from the operation house which is back of the A-frame on the front of the craft. In the blue clay the output of these dredges runs an average of about 15 per cent solid matter, and the usual work of the machine has been 1,000 cubic yards in two 10-hour shifts. These dredges were made by the Morris Machine Works, Baldwinville, N. Y.

A power scraper of the type designed by Mr. Charles Vivian and used by him on the Chicago Drainage Canal was used for much of the dry work on the surface, this machine taking out about 800 cubic yards per 10-hour day. It consisted of a large and heavy scraper arranged to be dragged by steel cables forward and back across the work and automatically upset with its load when arriving at the spoil bank.

Steam shovels were employed in a very difficult indurated clay filled with large boulders that was encountered in the deep cuttings. The Andrews Ridge cutting is the deepest that was necessary upon the line, this being 95 feet deep, 500 feet wide at the surface and about one-third of a mile long. Steam shovels of the type manufactured by the Vulcan Iron Works Company, of New Britain, Ct., and known as 75-ton shovels, were employed as were also some Bucyrus shovels, one of the latter being stated to be the largest steam shovel in the world.

At the power house the excavation for the foundations of the building covered a considerable territory on the north bank of the Grasse River, the area of the building being 147 by 633 feet. Directly opposite this point, on the other side of the river a stone-cutting yard was started and here also was found room for the rock spoil-bank, which was later ground up to furnish concrete material. From bank to bank of the river, running between high towers, a cableway was constructed by the Lidgerwood Manufacturing Company, New York city, and by means of this the rock taken out (when it was found good enough to use in the foundations) was sent across the river to be dressed. About 30,000 cubic yards of the stone removed was broken up by rock crushers and mixed to make concrete with Empire Portland cement, the proportion being cement one part, sand from the river two parts, and broken stone five parts. The building itself is of iron, resting on an enormously heavy substructure of concrete, an excellent idea of which may be had from the two illustrations showing the lower portion of the unfinished power house with the journal-supporting rings of the turbines set in place. The building will be of the usual steel-girder construction with brick filling and its roof will be ceiled with wood. In this building will be installed, when it is eventually finished, the largest aggregation of power generating machinery in the world, comprising thirty 5,000 horse-power units, of which seven are at present being put in place.

The turbines used are of the Victor type, made by the Stilwell-Bierce & Smith-Vaille Company, of Dayton, and six wheels each 54 inches in diameter will be installed tandem on each shaft for direct coupling to a dynamo. These six wheels in each compartment of the dam will be mounted upon three draft tubes, and each wheel will develop 1,000 horse-power at its normal speed of 150 revolutions per minute. The diameter of the draft tubes, which are of steel, is 10 feet. The shaft is 12½ inches in diameter where it passes through the water-tight journal 30 inches long, the supporting rings for which are shown in two of the accompanying illustrations. To these machines will be attached governors manufactured by the same company that supplies the wheels themselves.

The dynamos will generate three-phase currents at 2,200 volts in each phase. The machines are of the revolving field type with external armatures, the field having 20 poles with 12 slots per pole per phase in the armature winding. The machines are guaranteed by their manufacturers, the Westinghouse Electric and Manufacturing Company, Pittsburgh, for a normal output of 5,000 horse-power, a maximum output of 7,500 horse-power and a full-load efficiency of 96 per cent with heating not to exceed 36 degrees under normal conditions of operation. The bearings on these gigantic dynamos are 16 inches in diameter and 65 inches long.

The immediate equipment of exciters will consist of three 300-kilowatt machines direct coupled each to a Victor turbine, 27 inches in diameter and giving current at 125 volts at their normal speed of 275 revolutions per minute. The switchboard will be of the pneumatic operated and electrically controlled type, so far as the sections of it relating to the large machines are concerned, and a standard direct-current switchboard for the exciters. In the centre of the station will be erected a sort of pulpit overlooking the room and here will be gathered all of the measuring instruments except totalizing wattmeters. From this point everything will be controlled and operated. The individual machine switchboards will each be located opposite its machine, and the feeder switchboards will be in adjoining bays. A double set of bus-bars has been provided. Two cables, each having three cores of stranded copper, highly insulated and lead-covered, will run from each machine to the switchboard going across the building in ducts. Feeder wires will be run through the gallery constructed for that purpose above the switchboard gallery and will be led to each end of the building where they go underground to distributing points and then further underground or overhead according to circumstances.

It is expected that the power generated at this plant will all be utilized in the immediate vicinity of Massena by various manufacturing and chemical industries which will be attracted to that point by the extraordinary facilities for power supplied by the new department. It will be noted that Massena is situated at a point convenient for shipping on two American and one Canadian railway systems and that the great power canal, taken in conjunction with the St. Lawrence and Grasse Rivers, forms a navigable water way giving connection to the sea on one side and the Great Lakes on the other. Probably the principal industries that will be developed in the neighborhood are those of paper-making, brick-making and chemical industries depending upon salt which is found at no great distance away. Just what the outcome will be industrially can not at present be said, because new conditions always give rise to new and unexpected combinations. The facilities for shipment possessed by the site, however, are so great that it is believed much crude material for manufacturing may be brought even from a distance to this point.

There has been some talk of building a ship lock at the power house end of the power canal, so that the power canal may become an American by-pass around the Long Sault Rapids. There is at present a canal through which vessels pass around these rapids, but it is on the other side of the river in Canadian territory. It is not expected at present that any work will have to be done on the Grasse River which has an ample section to carry away the tail water for a development up to about

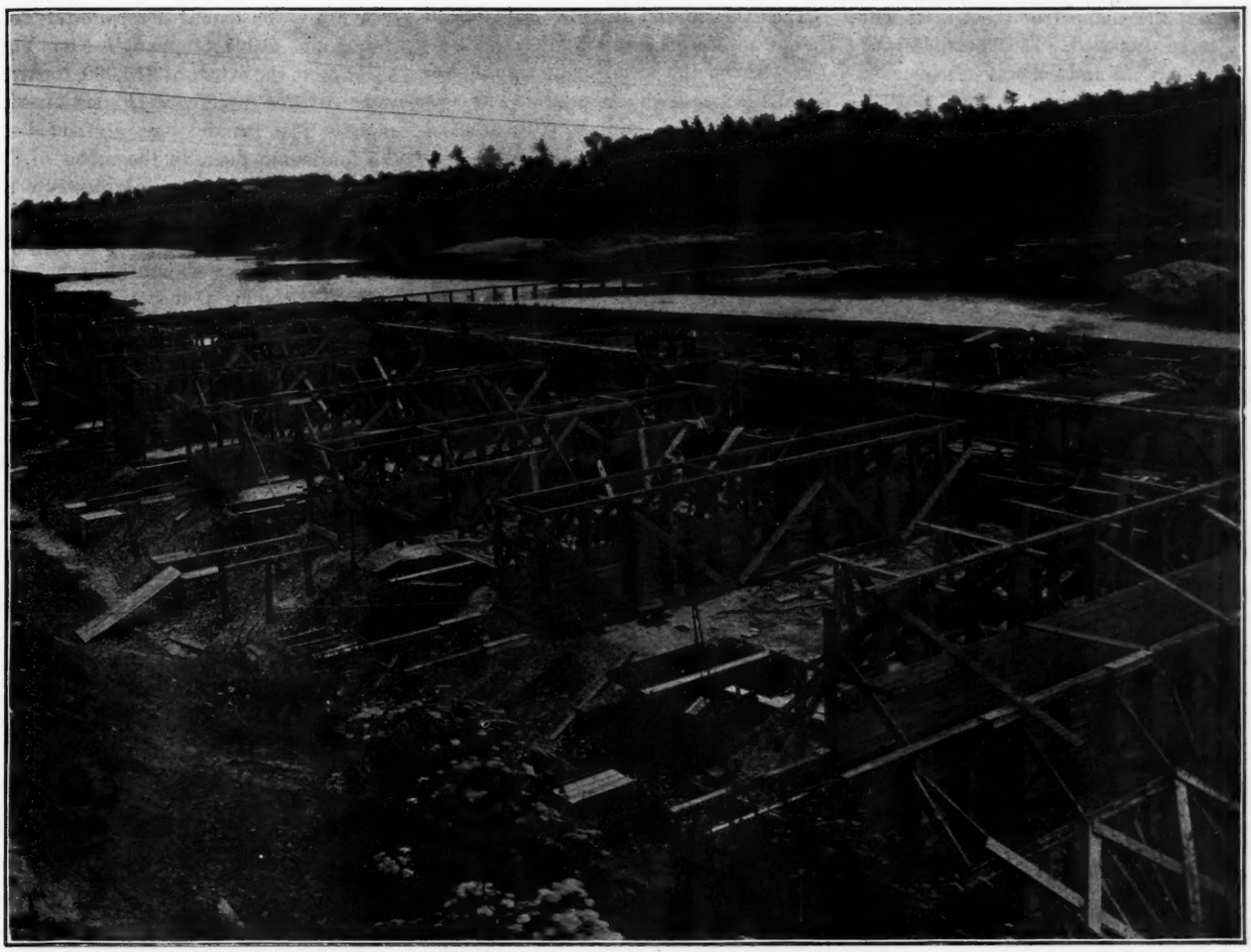


FIG. 9.—GENERAL VIEW OF THE UNFINISHED POWER HOUSE AT MASSENA, SHOWING WHEEL STATIONS, OPENINGS OF DRAFT TUBES, AND THE GRASSE RIVER IN THE BACKGROUND.

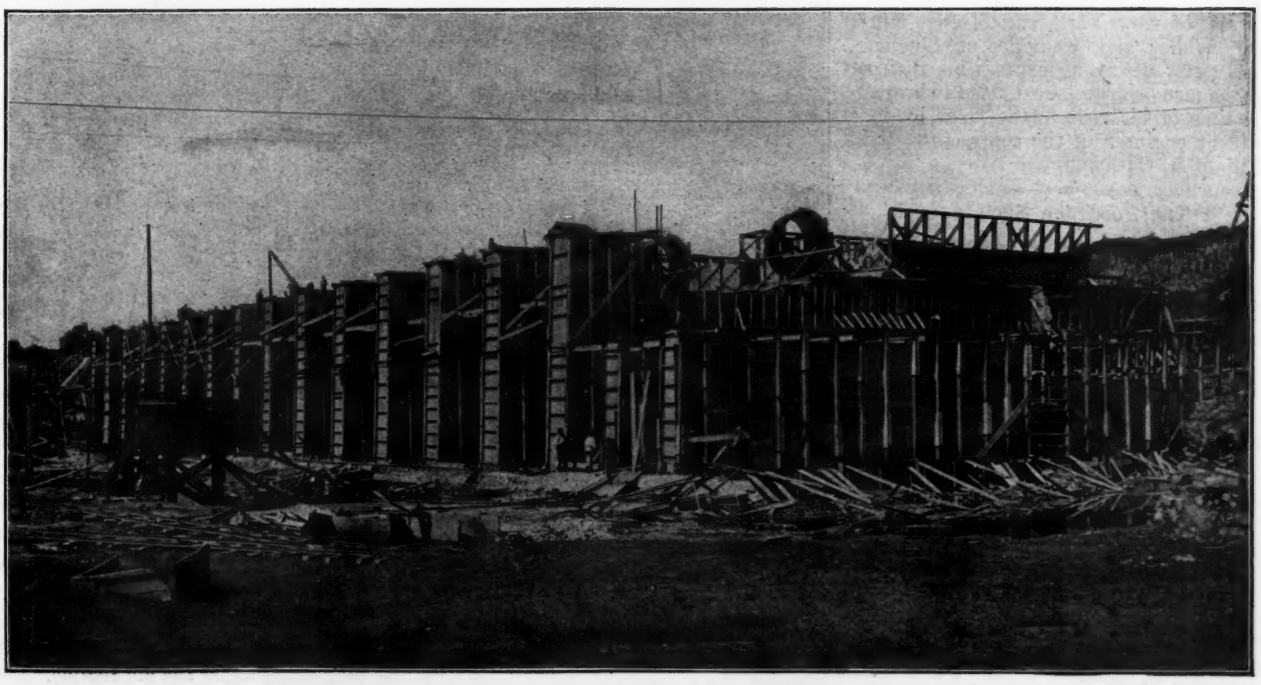


FIG. 10.—VIEW OF THE UNFINISHED POWER HOUSE AT MASSENA FROM THE TAIL RACE.

75,000 horse-power. When this limit is surpassed the channel of the Grasse will have to be deepened. It is possible with the power canal and general development now in hand to produce about 150,000 horse-power as a maximum.

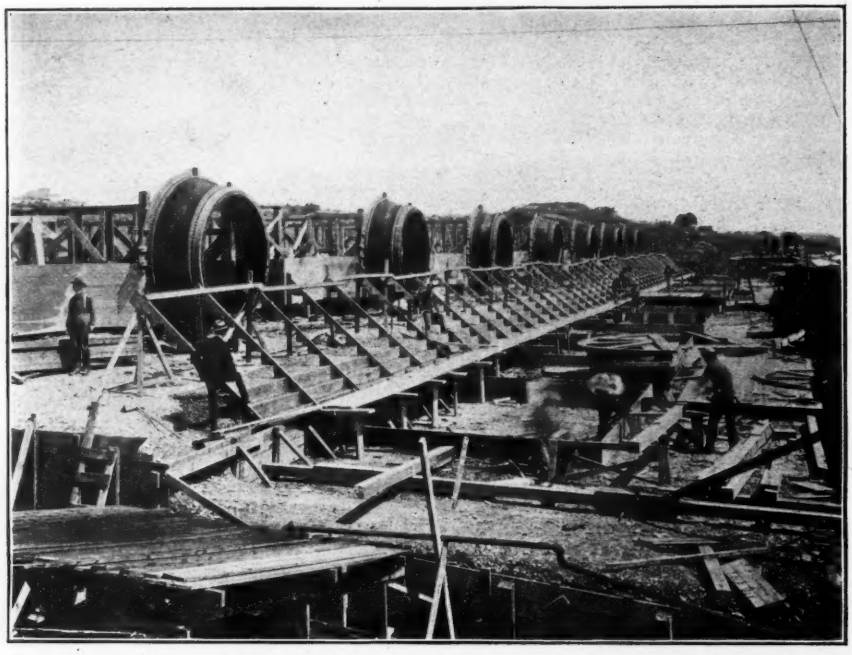


FIG. 11.—THE UPPER LEVEL OF THE POWER HOUSE AT MASSENA, SHOWING THE JOURNAL RINGS FOR THE TURBINES.

It is contemplated that the machinery will be turned over about the middle of May, 1901. Work on the canal is very near completion and the power house is considerably further advanced than the photographs here shown indicate, these having been taken in August last. The engineers of the enterprise were Mr. John Bogart, of New York, and Messrs. Kincaid, Waller and Manville, of London. The writer desires to express his thanks for the many courtesies extended to him at the time of his visit to the plant by the resident engineer of the contractors, Mr. William H. Cushman.

The Roentgen Society.

The first regular meeting of the Rœntgen Society will be held at the Academy of Medicine, 17 West Forty-third street, New York city, December 13 and 14, 1900. A full programme will be made public about November 25. Preliminary to this it is announced that the secretaries of all scientific, medical, surgical, dental, electro-therapeutic and other such societies are requested to send their names and those of the delegates representing them to the secretary, Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa, or to the assistant secretary, Dr. Carl Beck, New York. A large number of interesting papers will be read and it is believed that there will be a considerable exhibit of X-ray apparatus and methods.

National Electric Light Association.

The ELECTRICAL REVIEW is informed that as a result of letters written by President Cahoon the membership of the National Electric Light Association has been largely increased and is still growing daily. The association has recently purchased and sent to active members copies of Mr. M. J. Francisco's book "Municipalities *vs.* Private Corporations," which have proved of interest and value in many cases.

FIG. 12.—STEAM SHOVEL AT WORK ON MASSENA CANAL, FILLING INCLINE DUMP-CARS.

Fire in Postal Telegraph Building.

A fire which damaged the Postal Telegraph and Cable Company's New York building to the extent of $15,000, occurred shortly after nine o'clock on Tuesday night. The flames were discovered on the fourteenth floor, in the rooms of the Hardware Club, and two alarms were required. Directly below the Hardware Club is the operating room of the Postal Company, which was unusually busy on account of the big Democratic demonstration in Madison Square. The operators stuck to their wires until ordered away, when the expensive switchboard was covered to prevent damage. After three-quarters of an hour the fire was under control and the operators resumed work. Several prominent newspapers had wires leased for the occasion, among them the San Francisco *Examiner*.

Standard for Electric Supply Mains Introduced in England.

Representative manufacturers of electric supply mains in England have combined recently in the effort to do away with the confusion caused in specifications by the varying details of the old standards for mains and conductors. The Cable Makers' Association, of London, has brought out a set of suggestions intended to standardize the figures, and it is confidently stated that these figures are of great practical value and will go far toward obviating the confusion which was so perplexing under the old régime.

The Street Railway Convention.

THE NINETEENTH ANNUAL CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION, AT KANSAS CITY, MO.

Proceedings of the Second and Third Day's Sessions—Papers and Discussions—Mr. Walton H. Holmes Elected President—Exhibits and Exhibitors—Convention and Personal Notes.

WEDNESDAY'S SESSION.

The meeting was called to order by President Roach at 10.50 o'clock, A. M., and an announcement was made by the president that the order of business had been somewhat changed. The names of the nominating committee having been selected, they were read by the secretary, as follows: Chairman, John A. Rigg, Reading, Pa.; E. C. Foster, Lynn, Mass.; E. G. Connette, Syracuse, N. Y.; D. B. Dyer, Augusta, Ga.; Robert McCulloch, Chicago. It was requested that those present desiring the association to meet next year in their cities should communicate with this committee. Secretary Penington stated that invitations had been received from the Mayor of Cincinnati, the president of the Cincinnati League and President Kilgour, of the Cincinnati Street Railway Company.

A paper entitled "A Comparison of the Various Systems of Electrical Distribution for Street Railways," by Mr. C. F. Bancroft, of Boston, was then read in the absence of the writer by the secretary. This paper will be found in another column in this issue.

The discussion was opened by Mr. E. C. Foster, of Lynn, Mass., at the request of the president. He said that the subject was too technical for him and contented himself by complimenting the author. Mr. Connette and Colonel Dyer also took part in the discussion, as did Mr. C. W. Wason, of Cleveland.

The next paper was entitled "Painting, Repainting and Maintenance of Car Bodies," by Mr. F. T. C. Brydges, Chicago, and in the absence of the author was read by the secretary. Mr. Harrington, of Camden, N. J., gave a number of figures on the various operations made in repainting and painting cars, showing the difference between the various classes of work and contract and piece-work systems. Including the entire repainting of a car, its roof and trucks, for an 18-foot closed car, on the contract-piece-work system, the labor cost was $28, and the material cost $19.79. Under the usual system of hiring labor Mr. Harrington had found that the work cost from 50 to 100 per cent more for labor than under the piece-work system. After an announcement by the secretary that a trip would be made to the Armour's packing house at two o'clock that afternoon and that there would be a theatre party in the evening at the Coates Theatre, and a vaudeville entertainment provided by the supply men on Friday evening, the meeting adjourned until 11 o'clock the next day.

THURSDAY'S SESSION.

The meeting was called to order at 11.10 A. M., with President Roach in the chair, and immediately afterward, Secretary Penington made an announcement that 17 companies had joined the association at this meeting. They were as follows:

MR. WALTON H. HOLMES, OF KANSAS CITY, MO., THE NEWLY-ELECTED PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION. (See page 437.)

Dallas Consolidated Electric Street Railway Company, Dallas, Tex.

Danville Street Railway and Light Company, Danville, Ill.

Detroit, Rochester, Romeo & Lake Orion Railway Company, Detroit, Mich.

Jackson Railway, Light and Power Company, Jackson, Miss.

Kansas City - Leavenworth Railway Company, Kansas City, Kas.

Lebanon Valley Street Railway Company, Lebanon, Pa.

Meridian Street Railroad and Power Company, Meridian, Miss.

Schuylkill Traction Company, Norristown, Pa.

Hoosac Valley Street Railway Company, North Adams, Mass.

Ottawa Railway, Light and Power Company, Ottawa, Ill.

Ottawa Electric Railway Company, Ottawa, Ont.

Holmesburg, Taconey & Frankfort Electric Railway Company, Philadelphia, Pa.

Monongahela Street Railway Company, Pittsburgh, Pa.

Rockford Railway, Light and Power Company, Rockford, Ill.

Saratoga Traction Company, Saratoga, N. Y.

Terre Haute Electric Company, Terre Haute, Ind.

The first paper on the programme was entitled "Double-Truck Cars; How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," and was read by its author, Col. N. H. Heft, of Meriden, Ct. The paper was as follows:

In order to prepare a paper which would be of any value to the members of this association, it was necessary to learn the conditions governing the operation of double-truck cars on different systems. The conditions under which cars are operated vary to such an extent that it is impossible to construct and equip a car that can be operated with equal economy on each system.

In order to keep within the time allowed by the committee, and the more readily to convey to the members the writer's opinion as to the most desirable double-truck car, the subject matter will be taken up under the following divisions: 1st. Trucks. 2d. Electric motors. 3d. Double-truck car body and equipment.

The double truck for use on street railways has not received the attention it merits. These trucks have been constructed along the lines of the single truck, and to meet the varied views of railway managements.

One has only to observe the different styles of trucks now in use to find how at variance have been their views.

The 55 years' experience of the steam railroad in the development of the double truck now used by them, should be a warrant to the street railway managements in adopting only trucks that conform to the lines used by these roads; the diameter of wheels, with the tread and depth of flange changed only where conditions prevents using.

In the plates exhibited here is shown a double truck design along steam railway lines to meet the varied condition of street railway service. In the design of this truck it has been the aim of the designer to include all known good features of the present street railway truck, and to add improvements of value. This truck is constructed with a minimum number of parts consistent with safety, strength, accessibility, lightness and cost of maintenance.

In giving a brief description of the truck shown, it will not be necessary to mention the wheels further than to say that they are cast chilled, 33 inches in diameter, with

a three-inch wheel tread, flange, one inch, formed to fit the modern rail, weight 380 pounds.

The axles are of forged steel, high in carbon, with a two-inch hole bored through the entire length. The key seat at gear wheel fit is cut above the line of motor bearings and journals, as shown in plate No. 1, in order not to weaken the axle.

The oil boxes are constructed so that the journal brasses may be readily removed with dust guard placed in position from the under side of box. An extra guard is placed from the same side and where it will retain the oil at the highest point.

The journal brasses and boxes are finished in such a manner as to obtain the full journal bearing under all conditions.

The side frames are made from two three-eighth-inch steel plates, thus allowing the main equalizer to be supported between the two frames on long spiral springs. With this arrangement, the bar can be removed for repairs without in any way taking the truck apart. This form of frame allows the greatest accessibility to all parts, and the use of the extended equalizer bars, shown on plate No. 1, gives extended spring movement, with a perfect side movement on curves and at low places in the track, minimizing the blow to the car body, rail joints and special work, and reducing the cost of maintenance of track and equipment. The side frame is so strongly constructed at points where the transom joins the frame that it is not necessary to continue frame around end and connect with the other side of frame to keep the truck in alignment. This also allows the placing of the truck near the end of the car body without coming in contact with the steps.

The brake is placed on the inside of the wheel, without using a brake beam. This position insures the most positive action, with either hand or power and independent braking on each wheel. The wheel base, five feet six inches, allows the motors to be suspended between axles and transoms.

The writer, having had experience with heavy and light motors, mounted with two motors on one truck, the other truck being an idle or trail truck, as well as with one motor on each truck, has found that, while greater efficiency is shown with the latter method, the two motors mounted on one truck, shows a saving in labor and first cost of the trail truck, with less cost for maintenance.

Maximum efficiency, with minimum cost of maintenance, with both heavy and light motors, has been obtained by mounting two motors on each truck, making a four-motor equipment. With this form of equipment, higher speed and quicker acceleration are obtained with less power of consumption, both in the average and total for the whole trip.

After an experience extending from the time the first railway motor was constructed, the writer knows of no mechanical apparatus in which the development has been so rapid and the point of perfection so nearly attained. Yet the future promises even greater development, both in the direct and alternating-current motors. With the great corps of engineers employed by our large manufacturing concerns, working with the men who are operating these motors and constantly suggesting and demanding improvements, the ideal commercial car equipment will be developed. The writer desires to call the attention of electrical and mechanical engineers to improving ventilation, increased copper, insulation, bearings, hollow armature shaft, decreased armature speed and gearless motors.

The controllers have not, as far as space and weight are concerned, kept pace with the motors. This part of the apparatus should receive the attention of the best talent of our manufacturing companies. The four-motor controllers, in their present form, are large, cumbersome affairs, placed in that portion of the car body where it is inconvenient and expensive to support. A more satisfactory controller can be produced by using a small pilot controller placed on the platform, with some developed form of main controller underneath the car body.

From information furnished by operating department and personal observation, the writer is led to believe the following dimensions the most desirable: Length over all, 40 to 50 feet; Width over all, 7 feet 6 inches, to 8 feet 8 inches.

With the increasing demand from the traveling public for the extension of present systems to suburban districts with a more frequent service and increased speed, also the construction of long interurban lines, the present managements, to meet the demand are turning to the double-truck car constructed along the lines of the steam railroad coach.

On other plates will be found a double-truck car, which the writer believes will become justly popular. This car combines the largest number of good features and is so constructed as to admit of placing the electrical equipment where it is accessible and less liable to come into contact with the truck or brake equipment.

The car body can be carried at the lowest point and trucks placed near the end of body. This car gives the maximum efficiency, durability, speed, safety and seating capacity, attractiveness, and ease and comfort to passengers, coupled with the minimum cost of construction and maintenance, and less dead weight per passenger, based on seating capacity. The total weight is made up as follows: Trucks, 3,970 pounds each; four motors, 2,385 pounds each; car body and equipment, 12,300 pounds; making a total weight of 29,780 pounds. This amount divided by 63 passengers gives a dead weight of 473 pounds per passenger. The cars of to-day show a dead weight, based on the seating capacity, of full 700 to 1,100 pounds

While the writer does not claim that the truck and car body described are perfect, yet he believes they are along lines that will become attractive to managers when taking up the cost of operation. Decreased cost of operation can only be attained by purchasing equipments that are designed to perform a specific duty where all weights and speeds are known.

The discussion was opened by Mr. E. C. Foster, of Lynn, Mass., who said he thought Colonel Heft was in the right line in the way of making improvements. Mr. Foster described the equipment of the Lynn & Boston Railroad Company on a 16-mile line running out of Boston through several small towns on the north shore of Massachusetts Bay. On this line a maximum speed of 30 miles an hour is attained and the company had found that a four-motor equipment is more economical than a two-motor equipment. He thought, notwithstanding, that there was an increased consumption of power when four motors are used. The cars under which these motors are placed are 25-foot box cars or 12-bench open cars. Mr. Chamberlain, of Brooklyn, said that some innovations in the design of car bodies might well attract attention. He spoke of the construction of a car without longitudinal truss rods. He described a design of a 42-foot car, due to Colonel Heft, in which the body support is gained by a number of cross transoms built in the form of the ordinary iron body bolster, welded at the ends, filled in with wood, and supported through the centre with longitudinal I-beams. He thought that this plan had obtained the minimum of weight with the maximum carrying capacity. He questioned the effect that would result from an end collision with such cars. Mr. Chamberlain spoke at considerable length upon this phase of the subject.

In reply, Colonel Heft said that he had endeavored to give all the strength to the car longitudinally, lightening the upper portion of the car, but so constructing it that the upper portion is braced and tied to the lower portion both longitudinally, vertically and otherwise. Mr. W. E. Harrington, of Camden, spoke of the mooted character of the four-motor equipment question. He spoke of a number of tests made by him to secure data and said that he would file a statement of the results with the secretary for the information of members. Colonel Heft said in reply that he did not have his figures at hand, but that during the last three years his company had tested double-truck cars equipped with one, two and four motors, and it kept a close and accurate record of the results. The weights of the trains varied from 5 to 250 tons and the speeds from 5 to 65 miles per hour. His conclusion was that in no place did the four-motor car require more current except while accelerating, but it accelerated faster by this increased consumption. Both the average and total consumption of current, however, is less than with the four-motor equipment.

Mr. Wason inquired about the drilling of a hole through the axle and armature shaft, replying to which Colonel Heft said that he was willing to admit that this was a debatable proposition. About five years ago his company commenced using hollow axles and had been pleased with the results thus obtained. It had never had a broken axle of this character. Replying to Mr. J. I. Beggs, of Milwaukee, Colonel Heft said that the motors in the comparative tests were all the same size and used under the same car bodies. Mr. Beggs said that the results of exhaustive tests made by his company had been entirely opposed to the conclusions reached by Colonel Heft and went into a considerable discussion of the double-truck car problem. "We can get much better results from 150 horse-power in four motors under a car than we can with 250 horse-power in two motors under the car. That is our experience." Mr. Beggs related an interesting account of his company's effort to compete with the steam railroads and the development of a new 50-foot, four-motor, double-truck car for

this purpose. The steam roads throughout the Western States, he said, are beginning to realize that in electric lines they have real competitors for distances of 50 or 60 miles. It is proposed that the new cars described shall make 60 miles an hour with four 75-horse-power motors, and in case there is congestion of travel on any of the lines of his system running to Summer resorts, etc., four or five trailers can be hitched on behind one of these large cars and the whole train can still make from 35 to 40 miles an hour. Further discussions between Mr. Beggs and Colonel Heft brought out the fact that each was right concerning the power consumption of a four-motor equipment under the definite conditions for which each had tested it. Mr. Wason said that with two-motor equipments, some years ago, some of his suburban cars had been unable to make schedule, but that by replacing the two 75-horse motors much better results were attained, while the power consumption was very little larger. He thought that the lightening of a car for suburban service is questionable, because such cars must be strong. Instead of making the car lighter, we should make it stronger. An interesting point was brought out in further discussion between the speakers mentioned above and Mr. E. G. Connette, which was that it costs considerably less to maintain four motors than to maintain two motors which will do the same work, and that the difference in the maintenance cost will more than offset the interest on the increased investment.

General View of the Exhibition at the Kansas City, Mo., Convention of the American Street Railway Association.

President Roach called upon Mr. H. H. Vreeland, of New York, to say a few words regarding his experience in this matter. Mr. Vreeland said:

"We have gotten into a rather technical discussion. I do not claim to be a technical man. Our peculiar conditions in New York are such that we can not go into the character of construction which warrants the use of the standard double-truck car with four motors. We do it on a number of lines controlled by the syndicate which owns the New York lines, and wherever it is possible, and we are not held down to the matter of a sixteenth of an inch in step heights, as we are in Greater New York, we go to the square body car and use the four motors. The peculiarity of our streets in New York is such that longitudinal lines, by reason of Central Park, have to use very narrow streets. We have to conform to the old type of construction, with sunk panels, to keep the cars moving. We have a number of cross streets through which the important lines operate, and the difference between the sunk-panel car and the square-body car means keeping the line in operation all the time, as against stoppage every once in a while of from 10 to 20 minutes, owing to the numerous teams using the streets during the day. On our Fifty-ninth street line, running across town, if an ordinary truck is standing on the curb, the hub will go under the sunk panel on our car; and if we used a square-

body car, we should not be able to pass. We also find it necessary to have step raisers.

"I want to say, as I said not long ago on this proposition, and has been expressed a number of times, we are not trying to do gilt-edge railroading in New York. I mean to say that these things are not necessary. I had a man recently say to me that he thought that it was an unwise thing to have step raisers under the control of the motorman of an open car. It means to us on the down-town streets of New York that the motorman can signal the conductor to raise the step and pass a truck without a stoppage of the car, which, under the ordinary conditions of a solid step means a stoppage of the car, and when you are running the cars five seconds apart, as we do in Centre street, down town, it is a great advantage to be able to raise the step and allow the car to pass.

"The proposition under consideration is so local with us in that respect, that to discuss it from the standpoint these gentlemen have discussed it would not amount to much, except as concerns our experience with the Consolidated system, in New Jersey, where we run high-speed, long-distance, interurban cars. On that system, we use the large type of car with four motors. We get the largest carrying capacity car we can with the highest speeds, and not considering particularly whether there is more or less power consumed, if you can compete successfully with the surrounding steam railroad conditions. We have long lines, and, in every instance, they are in competition with the steam railroads.

"The Board of Railroad Commissioners of the State of New York made a very thorough test of brakes. While we had nothing to do with that test, our men put on the instruments. In this other instance of double and single-truck cars, which were equipped in each instance with two motors, there having been for a long time a question which car used the most power, we made some experiments and found that, with the same sized motors on single and double-truck cars, there was an increase of about 20 per cent in the consumption of current in the double-truck car. I speak of this, because I am uncertain whether it was due to the increased weight of the car or the increased length of the car. As far as the question of general car construction, which has been discussed here, is concerned, we have not to consider so much the question of collisions at high speeds, as we have the question of a "hogging" of the cars as we term it; and, as our friend, Mr. Wason, says, it is no trouble at all to get any kind of a camber in our Broadway cars, as the normal condition of the cars is such, as my friend, Colonel Heft, says, he usually prefers to walk down town and leave room for three passengers in the car."

The president then called upon Mr. Charles S. Sergeant, of Boston, who complimented Colonel Heft's paper and said that while he had had no experience in actual service with four-motor cars, careful tests had been made under what would be ordinary conditions, and that the results had shown better acceleration with the four motors.

"We got, as a matter of fact, 10 per cent decrease in time, better speed, but we had to use 50 per cent additional current to get it. I should suppose the question is one of local conditions. Certain electricians have been trying to persuade me for years that two motors consumed less power than one motor. We have records covering a good many years that one motor consumes less power than two motors.

"In regard to our elevated equipment, possibly we have been making a mistake. What we are intending to use is motor cars having one motor truck with two 150-horse-power motors on that truck. One motor truck and one trailer truck, every car a motor, using the multiple control system. I hope inside of the next year, if you come to Boston, we can show it to you in successful operation. It will be the only elevated road which will go underground as well as elevated, and we have to overcome long grades of five per cent, and descending grades of eight per cent, and, therefore, we feel we want the greatest protection we can get for acceleration."

Mr. Ira A. MacCormack, of Cleveland, Ohio, was then called upon and said:

"While I was with the Brooklyn Rapid Transit Company, the president of that company thought it was advisable to have double-truck cars, and the first car that was built had wheels all of one size, and the question came up whether it was advisable to put four motors on the car or two motors. Tests were made to decide this question, and it was finally decided to equip the cars with two motors on account of maintenance. An order was placed for double-truck car bodies. We had not yet determined whether we had the right kind of truck and whether it was still advisable to use the four motors or to use the two motors. We had some maximum traction trucks on the road, and in making the test in regard to the power and the efficiency of acceleration, it was found that the maximum traction truck was giving much better service. In consequence, we adopted the maximum traction truck, and I believe it was the only truck we could work with two motors and continue the service in Brooklyn. The 15 cars referred to were equipped with wheels which were all of one size, and we had to pull those cars off the road whenever we got three or four inches of snow on the ground. It was absolutely impossible to get them over the road. I complained to the president of the company, but he thought I was wedded to the maximum traction trucks and insisted on running them. One day he happened to be at Richmond Hill going to Brooklyn. It was a 24 minute run from Richmond Hill to Ridgewood. The president got on one of the cars with wheels all the same size, and he was 52 minutes getting there. He thought the wheels traveled a thousand miles. These cars were equipped with two motors. The next day, we discontinued the use of the 15 cars equipped with these trucks because we had so many delays. They dragged the road and it was found impossible to operate them.

"In Cleveland, when I went with that company, I found that all the cars were double-truck cars with wheels the same size. Some time ago I had a cyclometer put on the driving wheel, the wheels equipped with the motor, and a cyclometer on the idle wheel, and the record showed that the driving wheel made many more revolutions than the idle wheel. I do not know that I can do much more, Mr. President, for the information of the gentlemen, but I want to say, in reference to Mr. Heft's paper, that it will give us more food for thought and study than any other paper presented to this association. There is one important thing he speaks of, and that is doing away with the brake beams, having the brakes hung and operated direct, without brake beams. I think that is something that can be appreciated, particularly in view of the trouble we have had in regard to chattering brake beams and brake beams catching up rubbish on the road, and sometimes when we have accidents, we will find that brake beams are a large factor in them."

Mr. Robert McCulloch, of Chicago, said that the paper had been discussed entirely from the point of view of power economy and car strength. In the old days street railroads had cars 10 feet long that weighed 4,000 pounds, with one or two horse-power in front of them; now they have 46-foot cars weighing 20 tons, with over 250 horse-power aboard. Then the managers were

considering how to carry more passengers and how better to please the man with the nickel. He did not think it was a question of using a little more or less horsepower if passengers can be carried in greater safety and larger numbers. "We can well afford to burn an additional bushel of coal if we can carry a few more passengers to pay for it."

VIEWS OF SOME PROMINENT EXHIBITS AT THE KANSAS CITY CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

Mr. McCulloch's remarks ended the discussion, and, after the customary vote of thanks to the author, the secretary announced invitations from the East-Side Electric Railway Company, the Country Club, of Kansas City, and the American Stoker Company. The president then called upon the Committee of Nominations for its report. Before it was pre-

sented Mr. McCulloch suggested that those who were nominated should be called upon to state if they were in a position to give strict attention and time to the duties of the office and if not that they might decline the election and let some one else be put in. Mr. Rigg, the chairman of the committee, then presented his report, which selected New York city for the next place of meeting and nominated the following gentlemen for officers of the association:

For president, Walton H. Holmes, president, Metropolitan Street Railway Company, Kansas City, Mo.

For vice-president, Herbert H. Vreeland, president, Metropolitan Street Railway Company, New York, N. Y.

For second vice-president, N. H. Heft, president, Meriden Electric Railroad Company, Meriden, Ct.

For third vice-president, J. B. McClary, general manager, Birmingham Street Railway Company, Birmingham, Ala.

For secretary and treasurer, T. C. Penington, treasurer, Chicago City Railway Company, Chicago, Ill.

Executive committee, the president, vice-presidents and John M. Roach, Chicago; F. L. Fuller, Wilkesbarre, Pa.; George W. Baumhoff, St. Louis, Mo.; John R. Graham, Quincy, Mass., and John Harris, Cincinnati, Ohio.

The following resolution was unanimously passed by the committee:

Resolved, That the next meeting of the American Street Railway Association be limited to three days instead of four, and that the day set apart for the personal examination, by members, of the Supply Men's Exhibit, be the middle day of the interval.

The secretary cast the unanimous ballot of the meeting for the nominees in the usual way, and, after a few felicitous remarks by President Roach, Colonel Heft and Mr. Vreeland, thanking everybody for the various favors received, adjournment was taken, to meet the following evening at the Coates House for the annual dinner.

DELEGATES PRESENT AT THE CONVENTION.

Akron, Ohio—L. E. Beilstein, general manager, Northern Ohio Traction Company.

Asbury Park, N. J.—S. F. Hazelrigg, general manager, Atlantic Coast Line Electric Railroad Company.

Atchison, Kas.—J. A. Bendure, general manager, Atchison Railway, Light and Power Company.

Atlanta, Ga.—Ernest Woodruff, president; J. R. Gordon, director, Atlanta Railway and Power Company.

Augusta, Ga.—D. B. Dyer, president; C. O. Simpson, secretary and treasurer, Augusta Railway and Electric Company.

Birmingham, Ala.—J. B. McClary, general manager; D. B. Dimick, electrical engineer; George H. Harris, chief engineer, Birmingham Railway and Electric Company.

Boston, Mass.—Charles S. Sergeant, vice-president; Henry L. Wilson, auditor, Boston Elevated Railway Company.

Bridgeton, N. J.—H. J. Crowley, vice-president; B. Frank Hires, general manager, Bridgeton & Millville Traction Company.

Brockton, Mass.—Elwin C. Foster, general manager, Brockton Street Railway Company.

Brooklyn, N. Y.—Clinton L. Rossiter, president; Eugene Chamberlin, superintendent of equipment; William Robbins, Jr., division superintendent; Newton W. Bolen, division superintendent; Giles S. Allison, Brooklyn Heights Railroad Company.

Brookfield, Mass.—E. P. Shaw, Warren, Brookfield & Spencer Street Railway Company.

Buffalo, N. Y.—C. A. Coons, superintendent, Buffalo Railway Company.

Camden, N. J.—Walter E. Harrington, general manager, Camden & Suburban Railway Company.

Chester, Pa.—John A. Rigg, president; Joseph C. Lugar, superintendent, Chester Traction Company.

Chicago, Ill.—H. M. Sloan, general manager, Calumet Electric Street Railway Company. Robert McCulloch, general manager; T. C. Penington, treasurer; C. N. Duffy, auditor; C. E. Wilson, chief engineer; M. O'Brien, master mechanic; John Sills, assistant master mechanic; C. E. Lund, draughtsman, Chicago City Railway Company. John M. Roach, president; T. A. Henderson, general superintendent; F. L. Roach, Chicago Consolidated Traction Company; E. R. Gilbert, general manager, Chicago Electric Traction Company. John M. Roach, president; J. Millar, master mechanic; George Voigt, electrician, Chicago Union Traction Company. William Walmsley, superintendent, South Chicago City Railway Company.

Cincinnati, Ohio—W. H. Harris, Cincinnati Street Railway Company.

Cleveland, Ohio—John Ehrhardt, assistant secretary; C. B. Esty, master mechanic, Cleveland City Railway Company. Ira A. McCormack, general manager; W. G. McDole, auditor; E. C. Faber, general passenger agent; W. J. White, Cleveland Electric Railway Company.

Colorado Springs, Colo.—Frank C. Lawton, superintendent, Colorado Springs Rapid Transit Railway Company.

Columbia, Pa.—Frank S. Given, general manager, Canestoga Traction Company.

Columbus, Ohio—Michael S. Hopkins, general superintendent; P. V. Burington, secretary and auditor, Columbus Railway Company.

Council Bluffs, Iowa—W. S. Dimmock, general manager; W. G. Denny, foreman of shops, Omaha and Council Bluffs Railway and Bridge Company.

Dallas, Tex.—G. Van Ginkel, president, Dallas Consolidated Electric Street Railway Company.

Danville, Ill.—Samuel L. Nelson, general manager; Harry Evans, Danville Street Railway and Light Company.

Dayton, Ohio—Charles L. S. Tingley, secretary and treasurer, People's Railway Company.

Denver, Colo.—J. B. Hogarth, Denver City Tramway Company.

Des Moines, Iowa—A. G. Maish, secretary; W. G. Owens, superintendent; E. R. Emmons, J. E. Welch, Thomas Marlow, Des Moines City Railway Company.

Davenport, Iowa—James F. Lardner, general manager; John C. Huntoon, general superintendent; John D. Fish, electrical engineer, Tri-City Railway Company.

Detroit, Mich.—A. L. Parker, 2d vice-president, Detroit, Rochester, Romeo & Lake Orion Railway Company.

Fall River, Mass.—Robert S. Goff, president, Globe Street Railway Company.

Findlay, Ohio—C. D. Kinney, vice-president and treasurer; Charles F. Smith, manager, Findlay Street Railway Company.

Fond du Lac, Wis.—T. F. Grover, president, Fond du Lac Street Railway and Light Company.

Hamilton, Ont.—C. K. Green, manager; J. B. Griffith, purchasing agent, Hamilton Street Railway Company.

Harrisburg, Pa.—Mason D. Pratt, engineer, Harrisburg Traction Company.

Hazelton, Pa.—C. A. Bragg, Lehigh Traction Company.

Hoboken, N. J.—W. S. Hall, general superintendent, North Hudson County Railway Company.

Indianapolis, Ind.—James M. Jones, 2d vice-president; W. F. Milholland, treasurer and assistant secretary; Edward F. Burch, consulting engineer, Indianapolis Street Railway Company.

Houston, Tex.—H. F. MacGregor, vice-president and general manager, Houston Electric Street Railway Company.

Jackson, Miss.—Frank G. Jones, Jackson Railway, Light and Power Company.

Jersey City, N. J.—E. D. Hibbs, auditor; G. F. Chapman, general superintendent; A. W. Pratt, roadmaster, North Jersey Street Railway Company.

Johnstown, Pa.—H. C. Evans, director, Johnstown Passenger Railway Company.

Joliet, Ill.—Samuel G. DeCoursey, president; F. E. Fisher, general manager; A. S. Kibbe, engineer, Joliet Railway Company.

Kalamazoo, Mich.—J. B. Foote, chief electrician; R. L. Rand, general superintendent, Michigan Traction Company.

Kansas City, Kas.—W. H. Gabriel, vice-president; Herbert W. Wolcott, secretary; E. E. Comb, manager; H. E. Gabriel, assistant manager; H. S. De Neefe, superintendent; W. H. Hammond, passenger and claim agent; C. K. Stieg, electrical engineer, Kansas City-Leavenworth Railway Company.

Kansas City, Mo.—W. O. Hands, general manager; Charles E. Jack, auditor; H. De Coursey, East Side Electric Railway Company. Walton H. Holmes, president; C. F. Holmes, general manager; L. E. James, vice-president; D. B. Holmes, counsel; W. E. Kirkpatrick, secretary and treasurer; J. A. Harder, auditor; W. A. Satterlee, superintendent; J. W. Carter, assistant superintendent; H. C. Schwitzgobel, purchasing agent; D. W. Dozier, chief engineer; W. G. Becker, master mechanic; Charles Grover, electrical engineer; Edward Butts, line engineer, Metropolitan Street Railway Company.

Knoxville, Tenn.—Robert Kinsell Howard, superintendent, Knoxville Traction Company.

Lebanon, Pa.—Dr. Walter A. Rigg, director; K. A. Fichthorn, director, Lebanon Valley Street Railway Company.

Lowell, Mass.—E. C. Foster, general manager, Lowell, Lawrence & Havernill Street Railway Company.

Louisville, Ky.—T. J. Minary, president; T. H. Minary, assistant superintendent of construction; Samuel G. Boyle, secretary and treasurer, Louisville Railway Company.

London, Ont.—C. E. A. Carr, general manager, secretary and treasurer; E. R. Carrington, London Street Railway Company.

Lynn, Mass.—E. C. Foster, general manager, Lynn & Boston Railroad Company.

Memphis, Tenn.—Frank G. Jones, vice-president and general manager, Memphis Street Railway Company.

Meriden, Ct.—N. H. Heft, president, Meriden Electric Railroad Company.

Meridian, Miss.—John Kamper, Meridian Street Railroad and Power Company.

Merrimack, Mass.—James F. Wattles, director; Charles S. Clark, director, Haverhill & Amesbury Street Railway Company.

Milwaukee, Wis.—John I. Beggs, general manager; T. E. Mitten, general superintendent; G. J. Sunny, special agent, Milwaukee Electric Railway and Light Company.

Nashville, Tenn.—F. W. Child, director, Nashville Street Railway.

New Orleans, La.—W. B. Brockway, assistant secretary and auditor, New Orleans & Carrollton Railroad Company.

New York, N. Y.—Herbert H. Vreeland, president, Metropolitan Street Railway Company.

North Adams, Mass.—W. T. Nary, superintendent, Hoosac Valley Street Railway Company.

Norristown, Pa.—John A. Rigg, president; Samuel D. Missimer, chief engineer, Schuylkill Traction Company.

Oil City, Pa.—James H. Forbush, superintendent, Oil City Street Railway Company.

Omaha, Neb.—W. A. Smith, general manager, F. A. Tucker, general superintendent, Omaha Street Railway, Light and Power Company.

Ottawa, Ill.—F. S. Donnell, president, Ottawa Railway, Light and Power Company.

Ottawa, Ont.—J. E. Hutcheson, superintendent, Ottawa Electric Railway Company.

Pasadena, Cal.—W. H. Smith, general manager, Los Angeles & Pasadena Electric Railway Company.

Peoria, Ill.—L. E. Myers, general manager; N. C. Draper, superintendent, Peoria & Pekin Terminal Railway Company.

Philadelphia, Pa.—John A. Rigg, president; C. C. Long, electrical engineer, Holmesburg, Tacconey & Frankfort Electric Railway Company. John A. Rigg, president; George Hoeger, superintendent, Roxborough, Chestnut Hill & Norristown Railway Company.

Pittsburgh, Pa.—George S. Davison, general manager, Monongahela Street Railway Company. Charles Fitzgerald, superintendent; Robert T. Todd, general master mechanic, Consolidated Traction Company. C. S. Mitchell, auditor, United Traction Company.

Port Chester, N. Y.—G. Stanley Heft, electrical engineer, Port Chester Street Railway Company.

Portland, Me.—W. R. Wood, president; E. A. Newman, general manager; C. C. Pierce, general electrician, Portland Railway Company. William E. Dow, assistant superintendent; George E. Raynes, starter, Portland & Yarmouth Electric Railway Company.

Port Huron, Mich.—A. Dixon, president; W. L. Jenks, treasurer; H. A. Dixon, manager, City Electric Railway Company.

Quincy, Ill.—W. B. McKinley, secretary; L. O. Williams, superintendent, Quincy Horse Railway and Carrying Company.

Quincy, Mass.—John R. Graham, president and general manager, Quincy & Boston Railway Company.

Reading, Pa.—John A. Rigg, president; Samuel E. Rigg, superintendent, United Traction Company.

Rochester, N. Y.—J. H. Stedman, manager of transfers, Rochester Railway Company.

Rockford, Ill.—R. N. Baylies, president; T. M. Stephenson, manager, Rockford Railway, Light and Power Company.

Salt Lake City, Utah—Walter P. Read, superintendent, Salt Lake City Railroad Company.

Saratoga, N. Y.—E. A. Noyes, president; F. P. King, general manager, Saratoga Traction Company.

Schenectady, N. Y.—J. R. Lovejoy, director; W. Gibson Carey, director, Schenectady Railway Company.

Seattle, Wash.—Charles F. Wallace, engineer, Seattle Electric Company.

Sioux City, Iowa—J. Henry Ricker, secretary; E. O. Holmes, superintendent; C. M. Feist, master mechanic, Sioux City Traction Company.

Spokane, Wash.—L. R. Notbohm, superintendent, Washington Water-Power Company.

Springfield, Ill.—C. K. Minary, manager; T. H. Minary, electrical engineer, Springfield Consolidated Electric Railway Company.

Springfield, Ohio—John H. Miller, general manager; Springfield Railway Company.

St. Joseph, Mich.—W. Worth Bean, president, St. Joseph & Benton Harbor Electric Railway and Light Company.

St. Joseph, Mo.—W. T. Van Brunt, vice-president and general manager; J. H. Van Brunt, superintendent; T. C. Smallwood, O. T. Kass, St. Joseph Railway, Light, Heat and Power Company.

St. Louis, Mo.—Thomas M. Jenkins, general manager; Herbert O. Rockwell, assistant to general manager; Nathan Smith, electrical engineer; Charles S. Butts; E. J. Smith, T. C. Kimben, St. Louis & Suburban Railway Company. George W. Baumhoff, general manager; R. M. Douglass, superintendent; Frank J. Suda, assistant auditor; Frank J. Duffy, paymaster, St. Louis Transit Company.

Syracuse, N. Y.—Edward G. Connette, vice-president and general manager, Syracuse Rapid Transit Company.

Terre Haute, Ind.—G. C. Tripp, treasurer; M. C. George, electrician; B. M. Grosvenor, master mechanic, Terre Haute Electric Company.

Topeka, Kas.—Clifford C. Baker, president and treasurer, J. G. Slonecker, secretary; Charles Blood Smith, director; J. H. McCahan, superintendent of construction; Albert M. Patten, C. W. Hixon, Topeka Railway Company.

Toronto, Ont.—J. M. Smith, general manager; M. Powers, Toronto Railway Company.

Trenton, N. J.—John A. Rigg, vice-president; Peter Hurley, superintendent, Trenton Street Railway Company.

Venice, Ill.—Fred E. Allen, president; E. J. Spencer, secretary, Venice, Madison & Granite City Railway Company.

Washington, D. C.—George H. Harrier, vice-president; William F. Ham, treasurer, Columbia Railway Company.

Waterbury, Ct.—Charles M. Heminway, cashier, Connecticut Lighting and Power Company.

Webb City, Mo.—A. H. Rogers, president; E. J. Pratt, electrical superintendent, South West Missouri Electric Railway Company.

Westwood, Mass.—John R. Graham, Norfolk Western Street Railway Company.

Wilkesbarre, Pa.—John A. Rigg, president; T. A. Wright, superintendent, Wilkesbarre & Wyoming Valley Traction Company.

Wilmington, Del.—John A. Rigg, president; A. V. Arrowsmith, director, Wilmington City Railway Company.

Willoughby, Ohio—Charles W. Wason, president, Cleveland, Painesville & Eastern Railroad Company.

Worcester, Mass.—A. H. Stone, treasurer, Worcester Consolidated Street Railway Company.

Youngstown, Ohio—A. A. Anderson, general manager and treasurer, Mahoning Valley Railway Company.

EXHIBITION AND CONVENTION NOTES.

The W. R. Garton Company, Chicago, Ill., was represented by Mr. Garton.

The Johns-Pratt Company, Hartford, Ct., was represented by Mr. E. B. Hatch.

The Chicago Mica Company, Valparaiso, Ind., maker of mica electrical specialties, was represented by Mr. Chas. W. Cobb.

The Bethlehem Steel Company, South Bethlehem, Pa., was represented by Mr. H. P. Porter.

The Falk Company, Milwaukee, Wis., was represented by Otto H. Falk and C. C. Smith.

The National Carbon Company, Cleveland, Ohio, was represented by Mr. Henry J. Davies.

The Electric Installation Company, Chicago, was represented by Messrs. Fitch and Brett.

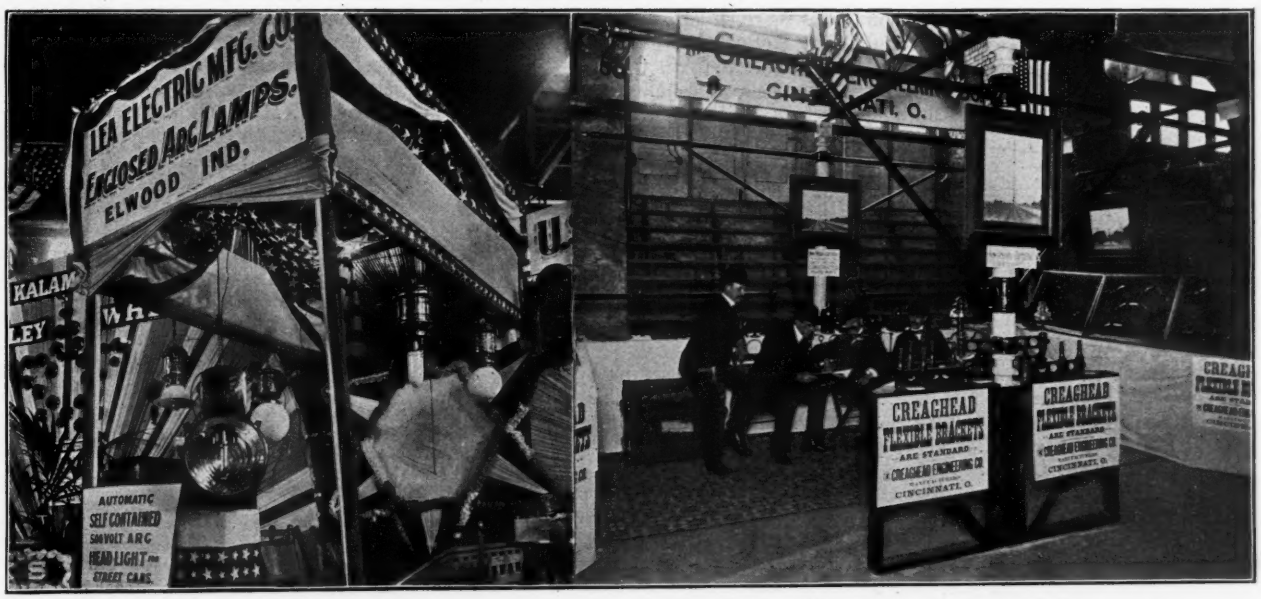
The American Vitrified Conduit Company, New York, was represented by Mr. B. S. Barnard.

The Partridge Carbon Company, Sandusky, Ohio, was represented by Mr. Partridge in person.

The Okonite Company, New York, was represented by Mr. Geo. T. Manson, general superintendent for the company.

The Joseph Dixon Crucible Company, Jersey City, N. J., was represented by Mr. W. B. Allen, of the Chicago branch.

The Columbia Machine Works, Brooklyn, manufacturer of railway supplies, was represented by Mr. W. R. Kerschner.



EXHIBITS OF LEA ARC LAMPS AND CREAGHEAD FLEXIBLE BRACKETS AT KANSAS CITY CONVENTION.

The Pantasote Company, New York, was represented by Mr. John M. High.

The Garl electric gun was shown in operation. This device is used for fire and burglar alarms.

The New Haven Car Register Company, New Haven, Ct., was represented by Messrs. Bradley and Boyd.

The Griffin Wheel Company, Chicago, manufacturer of car wheels, was represented by Mr. C. K. Knickerbocker.

The Columbia Incandescent Lamp Company, of St. Louis, was represented by Mr. G. E. Watts, of the home office.

The Sterling-Meaker Company, New York and Chicago, maker of car registers, was represented by Mr. E. F. Wickwire.

The Garl Electric Company, of Akron, Ohio, exhibited the Garl telephone apparatus for railway, hotel and factory service.

Mr. J. L. Speer, of the Speer Carbon Company, St. Marys, Pa., was present and distributed as a souvenir a unique card case.

J. M. Atkinson & Company, Chicago, was in evidence in the person of W. E. Pimlott. Mr. Atkinson is at present in Europe.

The Creaghead Engineering Company, Cincinnati, Ohio, made a comprehensive exhibit of the Creaghead overhead construction specialties.

J. G. White & Company, Incorporated, New York, engineers and contractors for street railway construction, were represented by Mr. C. G. Young.

The Cutter Company, Philadelphia, had an interesting exhibit of the "I. T. E." circuit breakers. The company was represented by Mr. I. P. Gilpin.

Harold P. Brown, New York, had one of the largest spaces in the exhibition hall devoted to practical demonstrations of the Edison-Brown plastic rail bond.

The Darlington Electric Fountain and Supply Company, Philadelphia, was represented by Mr. F. W. Darlington, who has recently returned from England.

John A. Roebling's Sons Company was represented by M. R. Cockey and associates, of New York, and Mr. Geo. Bailey, of the company's Chicago branch.

The Keystone Electrical Instrument Company, Philadelphia, maker of the Keystone electrical measuring instruments, was represented by Mr. W. R. Garton.

The Lorain Steel Company, Lorain, Ohio, manufacturer of railway motors and street railway equipments, was represented by Major J. D. Evans, of New York.

The Ohio Brass Company, Mansfield, Ohio, showed a large line of overhead trolley construction specialties, and was represented by Messrs. Wilkinson and King.

The Peckham Truck Company, New York, was represented by Mr. Peckham, president of the company, and the Chicago representatives, Messrs. Hannah and Gray.

The Michigan Electric Company, Detroit, Mich., was represented by President Jos. E. Lockwood. This company is doing some very interesting street railway work.

The New York & Ohio Company, Warren, Ohio, was represented by Mr. W. D. Packard and Mr. W. N. Matthews. This company makes the well-known Packard incandescent lamps.

The Sprague Electric Company, New York and Chicago, was represented by Mr. E. B. Kittle. This company installed the electric railway system now in operation on the Brooklyn Bridge.

The Pittsburgh Reduction Company, of Pittsburgh, Pa., had Mr. J. H. Rutheford at the convention and had an extensive exhibit of aluminum cables, wire and other aluminum products.

The Weber Gas and Gasoline Engine Company, of Kansas City, Mo., had two large gas engines on exhibition, and was represented by R. C. Weber, secretary, and H. C. Weber, superintendent.

Mr. John T. McRoy, New York, manufacturer of the vitrified clay conduit of the same name, was present in person, and was represented by Mr. James M. Graves. Mr. McRoy also made an exhibit.

The J. G. Brill Company, of Philadelphia, had, as usual, a large corps of gentlemen at the convention, among whom were: G. M. Brill, Samuel Kerwin, W. H. Haulings, Geo. Haskell and D. B. Dean.

A party of gentlemen identified with the construction of the electric line between Detroit and Toledo, came from Detroit. The party included Messrs. J. M. Mulkey, Jos. E. Lockwood, C. A. Black and C. G. Young.

The Lea Electric Manufacturing Company, manufacturer of the "Lea" arc lamps, was represented by its sales agent, Mr. W. H. Porter. The company exhibited a new 500-volt headlight and other new types of arc lamps.

The Cutler-Hammer Manufacturing Company, Milwaukee, was represented by Mr. C. H. Norwood, and exhibited a complete line of railway switchboards and appliances for current control in all their standard forms of rheostats.

The Standard Paint Company, New York and Chicago, was represented by Mr. J. C. Shainwold and Mr. J. F. Hicks, western manager. It had an artistically arranged booth for the display of the "P & B" products, and distributed a pretty souvenir.

The Merritt Electric Air Brake Company, New York, was represented by Messrs. J. S. Ward and C. H. Thompson. This company had an operating exhibit of the Merritt air brake system which was recently described in these columns.

The H. B. Camp Company, maker of underground conduits, Akron, Ohio, was represented by Mr. Guy M. Gest, of Cincinnati. This company had an exhibit of the Camp conduit, laid over with dirt, showing its appearance when in the ground and assembled.

The Bullock Electric Manufacturing Company, Cincinnati, Ohio, was well represented by Mr. F. G. Bolles, of the company's New York office. Mr. Bolles gave away very unique and novel souvenirs, which were pleasant reminders of the company's line of apparatus.

Rossiter, MacGovern & Company, New York, dealers in electrical apparatus of all kinds, were represented by Mr. J. H. Stewart. Mr. Frank MacGovern, of this company, was present in person, reaching Kansas City on the second day of the meeting, having just arrived from Europe.

The Morris Electric Company, of New York city, was represented by Mr. Elmer P. Morris. The Morris rail bond was shown for any size, shape or section of rail. This exhibit was shown in connection with McGill, Porter & Bery, of Chicago, who are western representatives of the Morris Electric Company.

The Weber Railway Joint Manufacturing Company, New York, made an interesting exhibition of its various types of railway joints. This included the following designs: T-rail joints, girder rail joints, insulated joints and compromise joints. Mr. J. C. Barr, from the New York office, was present for this company.

The Bay State Traction Company, New York, was represented by Lieut. F. W. Toppan, secretary and treasurer of the company. This company has recently perfected a new closed conduit system for electric railways, the invention of Mr. Lowell M. Maxham, which was described in these columns recently, and has features of great merit for this line of engineering.

The Dearborn Drug and Chemical Works, Chicago, was represented by Mr. W. H. Edgar, president; Mr. Charles F. Eddy, secretary, and Mr. A. E. Stanfield, the latter the St. Louis agent. This company manufactures a special boiler compound, which is used by many electric plants throughout the world. The company also manufactures very high-grade chemical specialties, such as lubricants, etc.

The Monarch Fire Appliance Company, New York, was represented by General C. H. Barney. The company, on Thursday, made an interesting exhibit by a practical demonstration, of the efficacy of "Kilfyre" as a fire extinguisher. Several hundred people watched the burning of the great pile of lumber prepared for the event and were amazed at the immediate extinction of the fire when "Kilfyre," a dry powder, was thrown on it.

The H. W. Johns Manufacturing Company, New York, was represented by the following gentlemen: Messrs. A. Hall Berry, manager of the electrical department; Jos. Sachs, T. D. Dickson, Philadelphia; J. W. Perry, H. D. Bayne, manager of the company's Pittsburgh office; S. H. Phinney, Chicago, and W. D. Buddecke, J. Kendal, St. Louis.

The Garton-Daniels Company, Keokuk, Iowa, was represented by Mr. J. V. E. Titus, secretary. The company exhibited a controller regulator to prevent "fast feeding" by introducing a time element on each movement of the handle; also this company exhibited standard types of Garton lightning arresters and a new extension circuit ringer for use on telephone lines, which restores itself, obviating a restoring shutter.

The Westinghouse Electric and Manufacturing Company, of Pittsburgh, Pa., exhibited a very complete line of its electric railway apparatus and supplies. Among them were included a 650-kilowatt direct-current, engine type generator, a 200-kilowatt rotary converter for street railway work and a switchboard for rail-

way service, having five panels completely fitted with all necessary switch and measuring apparatus. The company also exhibited five railway motors, one of them being partially wound and having its commutator only partially connected to show the method of winding, and, in addition, two railway motors mounted on a McGuire truck complete. There was also a considerable exhibit of lightning arresters, switches and circuit breakers, fuse blocks, diverters, volt and ampere meters and other auxiliary apparatus. The following gentlemen from the company were in attendance: F. H. Taylor, sales manager of the Westinghouse Electric and Manufacturing Company; N. W. Storer, electrical engineer of the Westinghouse Electric and Manufacturing Company; G. Berentsen, mechanical engineer, Westinghouse Electric and Manufacturing Company; W. H. Wells, sales manager, the British Westinghouse Electric and Manufacturing Company; W. M. Probasco, Westinghouse Companies' Publishing Department, Pittsburgh; P. N. Jones, connected with Pittsburgh office of the Westinghouse Electric and Manufacturing Company; R. S. Brown, connected with Boston office of Westinghouse Electric and Manufacturing Company; C. S. Powell, connected with Cleveland office of Westinghouse Electric and Manufacturing Company; C. A. Bragg, manager, Philadelphia office of Westinghouse Electric and Manufacturing Company; J. R. Gordon, manager, Atlanta office of Westinghouse Electric and Manufacturing Company; C. B. Humphrey, manager, Cincinnati office of Westinghouse Electric and Manufacturing Company; G. Pantaleoni, manager, St. Louis office of Westinghouse Electric and Manufacturing Company; H. C. Ebert, connected with Westinghouse Electric and Manufacturing Company, Pittsburgh; F. C. Newell, representing the Westinghouse Air Brake Company; W. S. Rugg and T. A. Hall, connected with Chicago office.

The Standard Underground Cable Company, of Pittsburgh, Pa., had on exhibition four large and handsome cabinets which attracted much attention at the National Export Exhibition, in Philadelphia, last year. In this display there were shown everything that is made in the lines of wires and cables, together with all accessories and appurtenances for underground and overhead construction work. The Standard Cable Company is now turning out its product from two new factories, one at Oakland, Cal., and one at Perth Amboy, N. J. The latter plant has an output even greater than that of the original plant at Pittsburgh. Mr. J. R. Wiley, Chicago, represented the company at the convention.

The General Electric Company, of Schenectady, N. Y., had a handsome exhibit consisting of four types of street railway motors of 25, 38, 50 and 75 horsepower, respectively. It also exhibited series parallel controllers of its well-known types for two-motor equipments and for four-motor equipments, and also an electric brake controller, adapted for use with two-motor equipments. In the same exhibit was shown a 500-volt, 600-kilowatt rotary converter and three 250-kilowatt air blast step-down transformers. A switchboard panel for 600-kilowatt both alternating and direct current for use with the rotary converter was also exhibited. A full line of overhead material and supply parts for railway motors was also shown. The following representatives were present: J. R. Lovejoy, A. H. Armstrong, W. G. Carey, J. G. Barry, Schenectady, N. Y.; S. W. Trawick, Atlanta, Ga.; J. C. Calisch, Buffalo, N. Y.; T. P. Bailey, F. N. Boyer, R. A. Swam, Chicago, Ill.; C. C. Pierce, Boston, Mass.; R. E. Moore, Philadelphia, Pa.; F. H. Strieby, Cincinnati, Ohio; H. E. Russel, San Francisco, Cal.; Geo. D. Rosenthal, St. Louis, Mo.; J. F. Schaefer, W. T. Osborn, Kansas City, Mo.

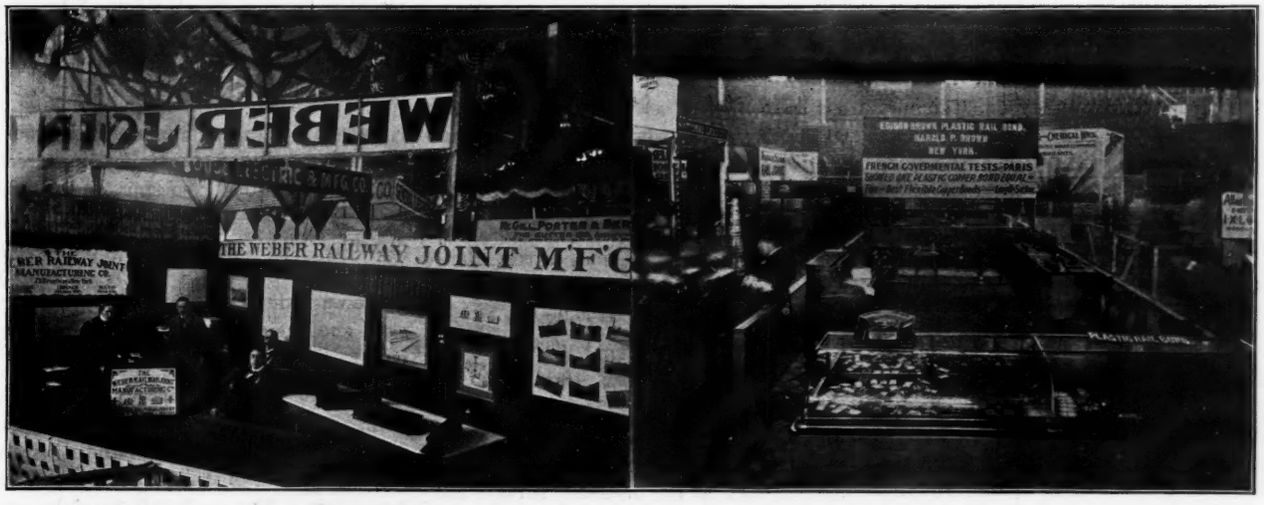
Friday afternoon the supply men, those who were exhibiting, gave an elaborate presentation of a variety show in the concert hall. Through the energy of two well-known gentlemen, Messrs. E. P. Morris and V. C. Gilpin, several hundred dollars were collected and an entire theatrical company was induced to reproduce its "turns" in the hall. The event was voted a success, as the hall was crowded and it is said that this feature of the week was one of the happiest episodes for the visitors.

Wendell & MacDuffie, New York, was represented by both Messrs. Wendell and MacDuffie. This company is agent in the East for a number of large manufacturers of street railway equipments, such as snow ploughs, sweepers, the general line of street railway specials made by the Falk Company, Milwaukee, the Rochester Car Wheel Company, the Composite Brake Shoe Company, the Taunton Locomotive Manufacturing Company, the Michigan Lubricator Company and several other lines of street railway equipments.

The Gold Street Car Heating Company, New York and Chicago, had one of the most prominently located spaces on the main aisle of the Convention Hall, in which were shown the most improved types of the Gold electric heaters. This company is a pioneer in the sphere of car heating and the usual Gold system is well known to engineers. In the Gold electric car heaters this company has embodied the highest principles of construction and in its apparatus it claims to have eliminated the elements of wire corrosion, burning out or short circuiting, and, above all, that they do not increase in consumption of current with usage. This company was represented at the convention by Mr. John E. Ward, E. H. Gold and James Watson.

The Cutter Company, Philadelphia, Pa., manufacturer of circuit breakers, was represented by Mr. V. C. Gilpin, manager of its New York office. The company also had an elaborate exhibition of circuit breakers as particularly adapted for street railway work, and several of the manufacturers of switchboard apparatus showed individual specimens of Cutter circuit breakers on their own installations.

The Frank Ridlon Company, Boston, was represented by Mr. Frank Ridlon, who is one of the earliest pioneers in American street railway operations. This company has recently obtained the entire equipment of the Boston elevated road for bonding. The protected rail bond will be used.



EXHIBITS OF WEBER RAIL JOINTS AND BROWN RAIL BONDS AT KANSAS CITY CONVENTION.

Electric Railways

Clarksburg, W. Va., will soon have an electric road which will eventually run to Fairmont.

Rome, N. Y., is soon to have an electric street railway, the franchise having been already granted.

A bond issue of $1,000,000 was recently voted by the stockholders of the Concord & Montreal Railroad to build an electric line from Concord to Hudson.

The trolley which is to be built between Sharon and Youngstown, Ohio, will cost $600,000 and will be constructed by Townsend, Reed & Company.

The Crestline branch of the Ohio Central Traction Company will be built early in the Spring. It is estimated that the extension will cost about $75,000.

It is stated that the Buffalo, Hamburg & Aurora, N. Y., Electric Railroad is shortly to be extended from Hamburg through several towns to Cattaraugus.

Nearly $100,000 is said to have been subscribed toward the laying of an electric railroad from Hervey City, Macon County, Mo., to Pana. Active work will soon be begun on the line.

It is stated by a local paper that the extension to the Niagara Falls electric plant, which is expected to be in operation by January 1, will produce 110,000 horsepower, which is already practically engaged.

The Lima-Findlay Electric Railroad is rapidly nearing completion and will be in active operation very soon unless some unforeseen obstacle should delay its completion. Eastern capital is said to be heavily interested.

Articles of incorporation have been granted to the Granville & Poultney Electric Railroad Company by the Vermont legislature and it is thought that the road will be a continuation of the Granville & Whitehall system.

The Chicago City Railway Company issued on October 1, $50,000 of new stock to holders of record September 13, which gives each holder one new share for every 26 shares of the old stock.

New York and Chicago capitalists have purchased rights of way from the Youngstown & Sharon Electric Railway Company, and work will be begun very soon, the contracts for building and equipment having been let. They have also purchased the Youngstown Gas and Electric plant.

The Chicago Union Traction Company will soon extend its North avenue line from Fortieth to Forty-eighth avenue, the permit having been issued, and the estimate for cost put at $100,000.

Capitalists of Junction City, Kas., are organizing a company to be capitalized at $80,000, its object being to build a street railway from Junction City to Ft. Reilly and the erection of an electric light plant capable of lighting both cities.

The Indiana Railway Company has been making numerous improvements and extensions to its lines lately, the last being the surveys for a new branch to connect the city of South Bend, Ind., with the towns of Niles and Buchanan.

The Wilmington, Del., Railway Company will shortly install an independent service on two street lines and will build a belt-line system across town. Transfers will be issued and work is already progressing on part of the belt-line system.

A branch line from St. Thomas, Ont., to Port Stanley will be laid in the near future by the St. Thomas Street Railway Company, which has just increased its capital stock from $100,000 to $250,000 to meet the expense of construction.

A franchise has been granted to the Shenandoah, Pa., & Pottsville Street Railway Company, by the town of Frackville, to operate a street railway. It will be built as soon as the necessary surveys can be finished, which will probably be late in the Winter.

A syndicate is reported to have offered a flat three-cent fare to the city of Chicago in exchange for a blanket street railway franchise covering all the territory now occupied by the Union Traction Company and the Chicago City Railway Company.

An electric railroad will shortly be made from Alpena, Mich., to Frankfort, touching the intermediate towns of Hillman, Atlanta, Haylord and Mancelona. The company will be known as the Alpena & Western Railway Company and has been capitalized at $1,000,000.

Plans have been prepared for the extension of the lines of the Central Traction Company, of Kokomo, Ind., from that city to Indianapolis. A power house will be built at Noblesville at a cost of $180,000. Two substations will be installed, and a spur running from Tipton to Elwood will be laid, bringing the total expenditure required up to $1,500,000.

The Massachusetts railroad commissioners have authorized the Globe Street Railway Company, of Fall River, to consolidate with the Taunton Street Railway Company and will also permit them to issue $525,000 additional stock.

Construction plans are being drawn for the electric street railway which will run from Worcester to Holden, Mass. It may be extended later to Jefferson and Rutland. Conservative estimates place the cost at about $150,000, $50,000 of which was voluntarily pledged at a recent meeting held by local capitalists.

Contracts are being made for a trolley line to extend from Pleasantville to Atlantic City, N. J., by the Atlantic City Passenger Railway Company, which has recently bought the Meadow Turnpike. Work is expected to begin in a very short time, and the line will be finished, unless all signs fail, in the Spring.

Poles are being put up along the route of the Greenville, S. C., trolley line which has been held up for so long, and several of the cars have already arrived. Some difficulty was experienced in unloading them from the train, but a temporary track was laid from the depot to the carshed and their transference was thus secured.

Work has been begun on the electric railroad which the Washington Cooperative Mining Syndicate is building from Fairfax, Wash., to their mines on the Carbon River. The road will be eight and one-half miles long when completed and will cost about $100,000. It will be built and equipped in the most modern manner. Seattle capital is heavily interested.

It is stated that the new power house which has been erected at Riverside, N. J., by the Camden & Trenton Traction Company will have to be rebuilt. It was originally erected on ground which was thought to be solid, but which has turned out to be a quicksand, and as the foundations and walls have settled materially, the building is considered unsafe and will have to be torn down and rebuilt.

The granting of a franchise for an electric line between Jackson and Ann Arbor, Mich., has been the basis of considerable friction between the parties to whom the franchise was granted, and the Detroit, Ypsilanti & Ann Arbor Railroad, which wished to enter the city of Ann Arbor on the West. Just how the fight will turn out is uncertain, but it is thought

that the line from Jackson will have a practical monopoly, as the town of Dexter is the key to the situation and its officials have refused to grant the Detroit road the privilege of building a stub line from the territorial road to Dexter.

Officials of the Palestine Mining and Development Company, of Palestine, Tex., at a recent meeting, authorized the construction of an electric line to connect the International & Great Northern Railroad and the coal mines, which are four miles distant. The rails for the road were telegraphed for, and contracts for the sleepers have been let. The work of construction was begun on October 15.

Oskaloosa, Iowa, has a "mule-car short-line" street railway system at the present time, but the agitation for some more modern means of conveyance has been so strong of late that the citizens have decided upon an electric or compressed air system. Nothing very definite has been accomplished as yet, but it is probable that a franchise will be given, a company formed and electric cars replace the primitive mule-drawn conveyances.

Evanston, Ill., is not likely to see the tracks of the Chicago, Milwaukee & St. Paul Railroad elevated for some time to come, as General Manager Williams of that road recently discouraged the town officials from hoping for anything of that nature, and now it is stated that, to even matters, they will, in all probability, refuse to permit the granting of the ordinance applied for by the road to change the motive power of the line between Chicago and Evanston from steam to electricity.

Legal obstacles at Providence, R. I., regarding rights-of-way in the electrical operation of the line between that city and Fall River, Mass., have been removed by an arrangement with the Union Street Railroad Company, of Providence, by which the New York, New Haven & Hartford Railroad Company's cars will be taken by the local corporation between East Providence and the Union Station. The new power house has been finished and the electric line will be opened early next month.

According to a local paper, the trolley line which has been built through the town of Folsom, Pa., has not only been a very profitable investment for its owners, but has proved to be the very thing that was needed to boom the town, inasmuch as the numerous vacant building lots, which gave the town rather a deserted air, have been improved and many of them purchased by parties that expect, in the Spring, to erect modern residences upon them. The paper goes on to state that the prospects of the town are brighter than they ever were before.

A large four-story brick car barn and office building will soon be erected in Milwaukee by the Ottawa, Canada, Electric Company, to cost about $500,000. It is also stated that the company expects to spend $10,000,000 on various improvements to their Milwaukee property within the next five years. A large force of men is at work in the San Antonio canyon in northern Ontario, Canada, erecting the new power house of the company. It is expected that it will be soon completed, and prove to be one of the most completely equipped in the country.

President Herbert H. Vreeland, of the Metropolitan Street Railway Company, of New York city, has stated that in the Spring work will be begun on the Kingsbridge franchise, and the road is expected to be in operation some time during the Summer. Nothing has been done on building the road as yet, because no power is available at the present time, and there will be none until the Summer, but by that time it is expected that the cable system of the entire road will have been changed to the electric underground trolley and then the Kingsbridge road will be opened.

A report from Boston, Mass., is to the effect that its 40 lines of street railway are to be merged into four operating systems. It is confidently expected that this will soon be accomplished and in a very short time all the lines north of Boston will be controlled by either the Lynn & Boston or the Lowell, Lawrence & Haverhill road, while to the south the West Roxbury & Roslindale Company will be paramount. The company which will operate the three Rhode Island lines will be the Newport & Fall River Street Railway Company. Petitions for these consolidations are now before the railroad commissioners, and when granted will greatly facilitate the operation of the roads concerned.

Ground has been bought in Indianapolis, Ind., by the local street railway for the purpose of erecting an immense storage battery and, eventually, a new power house, the idea being to prevent "dead" or slow cars, due to breaks in the current or overloads. It is proposed to run all the current through the storage battery, which will thus accumulate energy enough to run the entire system in case of a breakdown at the power house, and which will add its force to that of the line voltage during rush hours, when the system is heavily overloaded. It will also act as a regulator and minimize the variations in the current. A close estimate of the cost places the figures at $500,000, which includes not only the battery house itself, but the feed wires and the taking out and down of many of the wires now in daily use. All the minutiæ have not as yet been determined, but a general plan has been adopted as a basis from which the work may be laid out.

The following excerpt is from the columns of the *Mail and Express,* of New York city: "The Metropolitan Street Railway Company states officially that the sum of $5,500,000 was spent on improvements during the fiscal year which ended with last week. The amount included the cost of the power houses and of the change of motive power on the cable line. It is understood that the company will do no more construction until next Spring. Within the year nine miles of Lexington avenue have been equipped for electric traction, except the installing of the conductor batteries and insulators, which will not require a disturbance of the street surface. Six and one-half miles of Columbus avenue have been electrically equipped. Ten and one-quarter miles of the Broadway road have had new rails set and the street surface has been repaved. The Thirty-fourth street line, from Second avenue to the Hudson River, has been completely reconstructed, new rails and ties have been laid and the road is now under operation by electric storage battery cars. The Twenty-eighth and Twenty-ninth street line has been reconstructed, has been equipped with new rails and ties, has been repaved and is now being operated by compressed air cars. One Hundred and Thirty-fifth street, from Madison avenue to Lenox avenue, has been changed to underground, and this will admit the passage of cars from the Fourth avenue line to Lenox avenue to the car barn there. In Tenth avenue, from Forty-second street to Fifty-ninth street, the conduit construction has been completed. The tracks of the Metropolitan Street Railway have been connected with those of the Third Avenue Company in Amsterdam avenue at Manhattan avenue. President Vreeland said recently that, while this was not the largest year's work ever done, it was the most intricate and difficult. He added that there was no intention to operate the present cable line by electricity until next Spring, by which time he hoped to abolish the whole cable service on the lines of the Metropolitan and further reduce the cost of operation."

COMPARISONS OF THE VARIOUS SYSTEMS OF ELECTRICAL DISTRIBUTION FOR STREET RAILWAYS.*

BY C. F. BANCROFT.

The cost of generating electric power under the same conditions, as regards fuel, depends to a great extent on the amount of power generated and the capacity of the generating apparatus with reference to the average output required. Under ordinary operative conditions, with the same power factor, that is, the same ratio of output to capacity, the cost of power per kilowatt-hour from stations of less than 500-kilowatt capacity increases very rapidly as the station decreases in size. With from 500-kilowatt to 1,500-kilowatt capacity, the cost of power per kilowatt-hour decreases slowly as the size of the station increases. From 1,500-kilowatt to 2,500-kilowatt capacity the cost per kilowatt-hour decreases very little as the output increases and above 2,500-kilowatt station capacity the cost of power per kilowatt-hour becomes nearly uniform. This is due to the fact that in small plants the labor item is disproportionately large, and the general efficiency less than in larger ones, while in plants of 1,500-kilowatt output and larger the cost of labor remains proportionately nearly the same as the plant increases in size. It follows from this that there is often very little or nothing to be gained from an economical standpoint by substituting one station of 5,000-kilowatt capacity for two of 2,500-kilowatt capacity each, provided the local conditions as regards cost of coal, water, etc., are the same.

On a large system, requiring an average output of 12,000 kilowatts, even though the load be distributed within a five-mile radius of a practical station location, it will usually be found economical to generate power at several smaller stations rather than at one large station, provided the conditions as regard cost of fuel, water and real estate are about the same, as the cost of power station buildings and machinery per kilowatt of capacity and the cost of generating power per kilowatt-hour, with a station of 5,000-kilowatt capacity, is about the same as at a station of 10,000-kilowatt capacity. The interest on the saving in the cost of feed wire by having several stations, each located near its load, would more than offset the slight saving in cost per kilowatt-hour, due to the generation of power at one large station, and it also has the advantage that in case of fire or accident to one station, the other can usually be so interconnected as to temporarily carry the entire load, and thereby avoid much of the stoppage of traffic which would occur if the road was supplied entirely from one station.

For an example of what was called the first or standard 500-volt continuous-current system of distribution, a city may be cited in which the street railway lines radiate west from the centre of the city like the spokes of a half-wheel, with a radius of about five miles. Instead of having one large station at the hub of the wheel, the road is supplied with power from seven stations, distributed throughout the system having an aggregate capacity of over 26,000 kilowatts.

The generating and distributing system in use in one of our most densely populated cities may be taken as an example of the way in which the system of distribution adopted is governed by conditions outside of those indicated for the most economical generation and distribution of power to the car motors. Although this system is compact and will probably require an average station output of over 30,000 kilowatts, which, it would seem to the outside engineer, could be more economically distributed and almost as economically generated at several stations, the street railway company is installing a high-tension, alternating, direct-current system of distribution with a main station of 45,000-kilowatt ultimate capacity, and five rotary converter sub-stations of from 3,000-kilowatt to 6,000-kilowatt capacity each. It is probable in this case that the location of the power station and the system of distribution was governed almost entirely by the great cost of real estate at points suitable for separate power stations.

It frequently happens that several miles distant from a street railway system much cheaper power is obtainable than at or near the centre of the system. This may be due to an available water power, or to a difference in the cost of fuel, etc., at two points. In cases of this kind, the second, or what may be called the alternating direct-current system, is usually the most applicable. To transmit power at 500 volts in any quantity from a distance of 10 miles, or even less, is very expensive, owing to the large amount of copper required and the great loss. For instance, to deliver 500 amperes at 10 miles distance will require about 150 tons of copper, allowing a loss of about 30 per cent in the line. This same amount of power could be transmitted at 5,000 volts by an alternating direct-current system with about five tons of copper, and with a loss of less than 10 per cent in the line.

The weight of copper required to transmit power a given distance, other things being equal, is inversely as the square of the voltage; that is to say, if it takes 100 pounds of copper to transmit a certain amount of power a given distance at 500 volts, it will only take 25 pounds of copper to transmit the same amount of power the same distance with the same loss at 1,000 volts. It is owing to this fact that the alternating direct-current system is so applicable where the power has to be transmitted for any considerable distance, as it allows of the use of very high voltages on the line, 10,000 volts or more being in general use, which, by means of transformers and rotary converters, can be reduced to 500 volts direct current for the trolley wire at points where the power is required. For an example of this system of distribution, a street railway system may be cited which derives its power from a waterfall. Here the power is generated at a pressure of 2,200 volts, and is stepped up to 11,000 volts for the line. About 6,000 horse-power is transmitted at this voltage for a distance of about 21 miles. The voltage is then reduced to 500 volts, direct current by means of static transformers and rotary converters at five sub-stations, located at or near the points where the power is required.

The third system mentioned, the "booster" system, is chiefly applicable on lines where there is a light average load, but where, for short periods, an extra heavy load has to be taken care of. It would seldom be economical to supply an entire road with power by means of a booster system, as the greater part of the power generated by the booster represents wasted energy, which is usually generated in an extravagant way, as the power required to drive the booster varies as the square of the current in the feeder; that is to say, if it requires 50 horse-power to drive the booster with a load of 100 amperes, it will require 200 horse-power to drive it if the load is increased to 200 amperes. Line losses which necessitate the continuous waste of more energy than could be compensated for by an ordinary compound-wound railway generator are seldom economical, even on a portion of a system, but there are many cases where there is sufficient copper installed to take care of the average load economically, but where, for a short time each day, or for a few weeks in the year, owing to local conditions, the traffic is very unusually heavy.

In cases like the above, where the heavy traffic is of short duration, a well-designed booster system may save a large investment in copper at a total cost of much less than would be required to pay the interest on the copper investment. For an example of this method of distribution I might cite a street railway company which supplies power to its own lines by means of a standard 500-volt direct-current system, and which also supplies power to a smaller road about 13 miles distant by means of a three-phase, alternating-current system, using 5,500 volts on the line. Here the booster system is used in connection with the high-tension system. When it becomes necessary to repair the high-tension line, it was found expensive and inconvenient to do the work between the hours of 12 midnight and 4 A. M., the only time when the power was off, and as it was not considered safe to work on the line when it was in operation, a booster system was arranged to supply power to the distant road for short periods at times of light loads. A 200-kilowatt booster was installed at the generating station and was designed to raise the voltage one volt per ampere of current. Switches were installed at the sub-stations so that the high-tension line could be connected directly with the 500-volt feeders, some eight miles from the generating station, and the booster was arranged so that it could be readily connected to the high-tension feeders.

When it was necessary to replace broken insulators or make other repairs on the

* Abstract of a paper read before the American Street Railway Association, Kansas City, October 18, 1900.

line, the attendants were notified at the generating station and at the sub-stations, and, at a prearranged signal made by varying the voltage on the line, the alternators were thrown out and the booster thrown on in such a way that the power was only off from the trolley wire for a fraction of a minute. It was thus found quite practical to make repairs on the line while the booster was in operation, and the system proved very satisfactory for supplying power at times of light load, while repairs were being made; the load on the booster frequently running as high as 500 amperes, at which time the voltage generated by the booster was about 500, which, in addition to the 575 volts of the direct-current system, gave 1,075 volts at the generating end of the line, the voltage at the sub-station averaging about 450. While it would have been very expensive to run this booster for any great length of time, for the short time it was used the total cost was much less than the interest on the copper investment required to build a duplicate line.

The fourth system mentioned, or three-wire system, is most applicable to double-track lines, where one trolley is made positive and the other negative, there being about 1,000 volts potential difference between the two, the current flowing from the positive trolley wire through the car motors to the rail and from the rail through the car motors and the other track to the negative trolley. The track is usually cross-bound and also connected to the conductor or connecting the two generators, which are operated in series in the station. This connection with the track forms the third wire, and tends to equalize the voltage should there be more cars on one side of the system than on the other. This method of distribution is usually capable of saving from 20 per cent to 40 per cent in copper, according to the character of the track return. If well balanced, it also greatly reduces the electrolytic action on buried conductors, such as water pipes, etc., and is most applicable where there are excessive track losses with fair opportunities for a balanced load.

There are few roads in this country using the three-wire system of distribution, although it is used almost universally by lighting companies. This is probably due to the complications introduced in railway systems by the high voltage, usually about 1,000 volts, between the trolley wire and feeders on different sides of the system and the difficulty of balancing the load. The saving in copper, while not as great as in the three-wire lighting system, is still enough to warrant the extra complication, and under favorable conditions may prove very valuable.

I am familiar with only one example of this system of distribution. In this case there is very heavy traffic over a double-track line to a park about six miles from the power station. It was found impossible to handle the increased traffic on the ordinary 500-volt system with the existing feed wire. By reinsulating the line and operating it on the three-wire system, the efficiency of the distributing system was very much improved, and they were enabled to easily handle the increased traffic with the existing feed wire.

The fifth system mentioned, or the alternating-current system, is practically untried in this country. It seems peculiarly adapted to lines having long runs at uniform speed with few stops, such as lines connecting cities, rather than for ordinary street railway service. The alternating-current motors at present in general use are of the polyphase type, and require at least three working conductors, which is a serious objection in many cases for railway work, as it necessitates the use of two trolley wires in addition to the track as conductors. The disadvantages of this system appear to be the necessity for at least two trolley wires and the probable difficulty in building alternating-current motors suitable for railway work which will have a good power factor.

The main advantage of the alternating-current system is the possibility of feeding lines with stationary transformers which need no supervision, but which can be considered simply as a part of the feeder, thereby multiplying many times the length of line which can economically be supplied with power from one station. The alternating-current motor also has the advantage of running at fairly constant speed independent of the load. It will not race going down hill if the power is left on, but will return power to the line, nor will it slow down much in going up hill.

The sixth system referred to, or storage battery system, is decidedly more expensive than the usual methods of electrical distribution, owing to the great first cost and the short life of the batteries. Lead is at present the only metal capable of resisting the attacks of sulphuric acid, and modern batteries consist largely of lead, which is very undesirable from a mechanical point of view and is very heavy, so that unless the present type of storage battery is substantially improved this system is likely to be used only where other systems are not practicable owing to peculiar local conditions or restrictions. The storage battery, however, has a large field in connection with the other systems of electrical distribution for street railways, and under favorable conditions may considerably increase the station capacity and reduce the fuel consumption; and when used on the line may greatly improve the regulation and increase the copper efficiency.

A wealthy citizen of Yonkers, N. Y., was recently suffocated and nearly killed by the escape of gas from his gasoline automobile before he was discovered. The gentleman in question is blind but that does not prevent him from being an ardent sportsman. The cause of the accident was the leakage of gas from the machine, and being dazed by the fumes the unfortunate man became bewildered and could not find his way out of the barn where the vehicle is kept and was unconscious and barely alive when found some hours later.

Walton H. Holmes, President of the American Street Railway Association.

Mr. Walton H. Holmes, the newly-elected president of the American Street Railway Association, comes of a family which has been actively interested in street railway matters since 1870, when the first horse car lines were laid, the town of Kansas City being then only a small way-station on the line of the steam railroad. This line was promoted and operated by Mr. Nehemiah Holmes, father of the present president, and was built by the Westport & Kansas City Horse Railway Company, being known as the Metropolitan Street Railway Company, of Kansas City.

In 1878, Mr. Robert Gillham evolved a cable system, to replace the old horse traction, which was finished in 1885, and in 1884, Mr. Walton Holmes, who was then president of the Westport & Kansas City Company, became interested in a new plan, which proposed to substitute electricity for the cable as the means of propulsion. Experiments were continued under the patronage of Mr. Holmes and Mr. T. C. Henry, of the same road, who, in 1887, organized the Kansas City Electric Railway Company, and built a double-track line on Fifth street.

Mr. Holmes has been identified with the movement from its inception, and has been a member of the executive committee of the Metropolitan Company for the past year, taking a lively interest in every theory and plan for promoting the welfare and progress of the road. He was also the chairman of the banquet and entertainment committee at the present convention. His brother, Mr. Conway F. Holmes, is the general manager of the line, and has been interested in the same companies and operations, being prominent for many years in the councils of the Westport line.

New York Electrical Society.

The two hundred and eighth meeting of the New York Electrical Society will be held at the College of the City of New York, Twenty-third street and Lexington avenue, on Tuesday, October 30, at 8 P. M. The evening will be devoted to a symposium on the Paris Exposition and the Paris Electrical Congress. The subject will be profusely illustrated by lantern slides. Addresses on its various branches are expected from President Hering, of the American Institute of Electrical Engineers; Dr. A. E. Kennelly, Professor F. B. Crocker, Mr. C. O. Mailloux, Mr. T. C. Martin and others who have visited the exposition and participated in the congress.

Electric Lighting

The city of Berlin, Wis., has decided to buy the Berlin Electric Light Plant for $12,000.

The city of Corsicana, Tex., has recently approved the building of a municipal electric light plant.

The city council of Marblehead, Mass., expects soon to enlarge its electric light plant at a cost of $10,000.

Improvements to the Toronto Junction, Ont., municipal electric light plant will be made in the near future, the cost being $12,000.

The state capitol building in Springfield, Ill., is shortly to have a new electric light plant, the cost of which is estimated at $20,000.

Contracts for an electric light plant to cost about $30,000 will be let very soon by the Franklin Water, Light and Power Company, of Franklin, Ind.

A sale of $45,000 in bonds has been advertised by the clerk of the town of Weiser, Idaho, for the purpose of building a municipal electric light plant.

The question of a municipal electric light plant is being discussed by the city officials of La Crosse, Wis., and it is stated that the plant will probably be erected in the near future.

The Southern Electric Light Company is shortly to built a plant at Navasota, Tex., which will operate 25 1,000-candle-power arc and 2,000 16-candle-power incandescent lamps.

Bids are soon to be received by the city council of Kalamazoo, Mich., for the erecting of a plant to light the suburban streets or to let the contract for it to some established company in that vicinity.

Cumminsville, Ohio, has petitioned the board of public service of Cincinnati for Welsbach burners, claiming the service now given them by the Edison Electric Light Company is unsatisfactory.

The citizens of Hempstead, L. I., have recently voted an issue of $100,000 in bonds to meet the expense of erecting an electric light and waterworks plant, which will probably be operated by the city.

Improvements to the power house of the Lexington, Ky., Railway Company, which will include the installation of an engine whose capacity will be 3,000 incandescent lights, will shortly be made and the lamps installed.

The citizens of Woodstock, Ont., are to purchase the local electric company's plant, which will be enlarged and improved at a cost of $30,000. The city will issue $30,000 worth of bonds to meet the expense.

The Merchants' Electric Light, Heat and Power Company has been incorporated at York, Pa., with $750,000 capital stock. It is expected that the company will erect an electric light plant early in the Spring.

The purchase of the electric lighting plant in Astoria, Ill., has been voted by the village trustees, who have taken possession. They will pay the old company a yearly instalment of $1,083.75 for the next 10 years.

The old plant of the Lake Charles, La., Light and Water Works Company will be shipped to the town of Jennings at the close of the present season, and a new and much larger system will be inaugurated at Lake Charles.

The Hattiesburg Light and Power Company, of Hattiesburg, Miss., recently purchased the Hattiesburg Electric Light and Manufacturing Company, and are now remodeling the entire plant and installing new machines which will double their present capacity.

Munich, Bavaria, has a battery of accumulators used for electric lighting and traction which were recently flooded by an exceptionally high tide and overflow of the river Isar, but in spite of the fact that they were completely submerged, they continued to work successfully.

A parlor car of the Florida East Coast Railroad has recently been fitted with electric lights and fans. It is said that the experiment has proved very successful, the car being both light and cool while dustproof with all the windows down, which makes Summer travel very pleasant.

It is probable that the negotiations now being conducted between the Green Bay & Mississippi Canal Company and the Appleton Electric Light Company, of Appleton, Wis., will result in the erection of a new power house at the upper dam, on the site of the old Atlas Pulp Mills.

Merchants of Joplin, Mo., have in consideration the building of a large private electric lighting plant for their own use. Six of the leading firms have already subscribed for stock in the proposed company, and as soon as sufficient money has been pledged the enterprise will be begun.

Florence, Ala., has granted a franchise to Edward J. O'Beirne, of Birmingham, to light the city. Arrangements have also been perfected to light the towns of Sheffield and Tuscumbia from the same plant, whose power will be derived from the Tennessee river, on the banks of which the power house will be erected.

A new company, the result of negotiations which have been carried on for some time past, has been formed in Baker City, Ore., and will be known as the Baker City Gas and Electric Company. It has absorbed both of the old lighting companies, as well as the Baker City Improvement Company, and has filed its articles of incorporation with J. T. Donelly, Edwin Fish and J. H. Parker as incorporators.

Noisy dynamos in the power house of the New York & Staten Island Electric Company, at Livingston, S. I., were the causes which led to the arrest and detention, under $500 bail, recently, of the company's engineer. It is charged that the plant is so noisy that residents of nearby streets are unable to sleep in peace, and it was with a view to abating the nuisance that a complaint was filed early in August with the Board of Health. The engineer's arrest is the result of investigations made by the Board of Health's inspectors.

It is reported that the big deal between T. K. Worthington, who acted for a Philadelphia, Pa., syndicate, and the Lancaster Gas and Electric and Edison Electric companies, of Lancaster, Pa., is off, as Mr. Worthington failed to buy them before the expiration of his options, which expired October 1. The reason for his failure to buy was the declaration of a two per cent dividend by the gas company which was to be immediately payable. The broker objected, claiming that the syndicate for which he was acting was entitled to the money as he held an option on the company prior to the announcement of the dividend. The gas people, however, held firm, and as a result the purchase was not made.

Fan Manufacturers' Dinner.

A very delightful dinner was given Thursday evening, October 17, at the Arena, New York city, by several of the fan motor manufacturers. The gathering was purely a social one, and the gentlemen assembled to talk over the past year's business and attain a feeling of good fellowship among themselves. The table was very handsomely decorated, having in the centre a miniature lake with swans upon it, and was profusely covered with cut flowers. Several witty stories were told, and it was the common verdict that a very enjoyable evening was passed.

Views, News and Interviews

Photography will be extensively employed in the construction of New York city's new underground rapid transit railway system, the idea being to make pictures all along the route before the work is begun and monthly thereafter. In this manner cracked and leaning walls will be noted and all the photographs filed for reference in case of damage suits or claims of any kind by the property owners along the line.

While climbing the chimney of the Attleboro, Mass., Electric Company, Edmund Fletcher, one of the three famous "steeple Jacks" fell and was fatally hurt. The distance from the top of the chimney to the ground was 72 feet and it is stated that nearly every bone in his body was broken. Only a few weeks ago, one of his brothers fell from a chimney in Providence, R. I., and was supposed to be mortally injured, but a few days later he escaped from the hospital in the absence of his nurse, went home, and is now at work again.

One of the cars of a Hoboken, N. J., trolley company recently ran over and killed a little six-year-old girl. The car itself was upset by a policeman and several citizens to release the child, in spite of the orders of the conductor to drive the car on over the little one's body. When the case came up for trial, the superintendent of claims for the trolley company stated that the president of his road wished him to call the court's attention to the fact that the officer had been instrumental in damaging the car to the extent of $66. The Recorder eyed the man a moment in speechless indignation and then informed him that the matter was out of his jurisdiction.

Rev. Dr. H. H. Barbour, of the First Baptist Church, of Columbus, Ohio, has introduced an exceedingly unique method in his work. At one of his regular Sunday morning services, recently, he had a special transmitter, which was connected with the telephone in his study, placed on the pulpit just in front of him, and behind a pile of books. Proper connections were made at the telephone exchange, and in this manner one of the trustees of the church and a number of invalid members were enabled to hear the sermon, music and other features of the service. General Manager Frank L. Beam, of the Citizens' Telephone Company, heard the sermon distinctly at his office in Mt. Vernon, Ohio, 45 miles away. This ingenious clergyman intends to arrange also for a megaphone to be placed on the receiver at Shepard's Sanitarium, so that all the inmates, seated in a large room, will be able to hear the sermon. He also tried to connect his church with the police station and fire engine houses, but was refused the desired permission by the Director of Public Safety.

FIG. 1.—THE OLDS ELECTRIC STANHOPE.

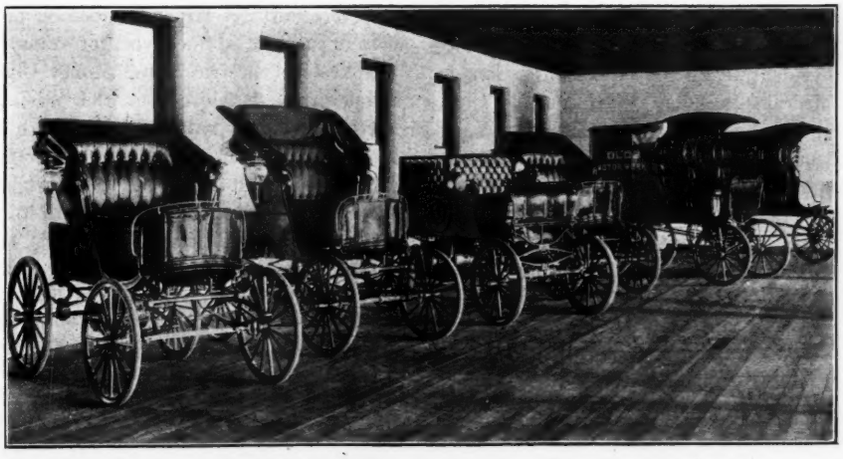


FIG. 2.—VEHICLES IN OLDS MOTOR WORKS SHOWROOM.

Free Lectures for Mechanics.

Three courses of free lectures on "Electricity," "Physics" and "Light and Heat" are being given in New York, under the auspices of the Board of Education. The courses will be delivered as follows: "Electricity", Baron de Hirsch Trade School, 222 East Sixty-fourth street; "Light and Heat," St. Bartholomew's Lyceum, 205 East Forty-second street; "Physics," Public School 86, corner of Lexington avenue and Ninety-sixth street. Wednesday, Thursday and Saturday nights have been chosen, and the courses began on October 10.

The Oldsmobile.

In the accompanying engravings are shown the principal types of the automobiles manufactured by the Olds Motor Works, of Detroit, Mich. The feature of these vehicles upon which stress is laid by the manufacturers is the placing of the propelling mechanism, which, being placed in the centre under-body of the machine, leaves the wheels free from all gears and chains, giving them the same appearance as the wheels of the ordinary horse-drawn conveyance.

In Fig. 1 is shown the Stanhope type, while Fig. 2 represents the company's showroom in which may be seen everything from passenger traps to delivery wagons.

The manufacturers claim high efficiency and low horse-power, stating that every machine will speed up to 10 miles an hour on one-half horse-power, which, they claim, is impossible with any other machine. This has enabled them to extend the mileage capacity of their vehicles to a very considerable degree, and as the motor, with all the other propelling and operating mechanism, is enclosed it is believed that it will stand unusually hard usage and severe tests without breaking down. A look at the engraving shows the handsome lines and neat finish of the vehicles, whose ease of manipulation and great mileage capacity makes them very desirable and convenient conveyances.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

FOURTH ANNUAL MEETING OF THE ASSOCIATION AT KANSAS CITY, MO.—PROCEEDINGS AND PAPERS—ELECTION OF OFFICERS.

The Street Railway Accountants' Association is an outgrowth of the American Street Railway Association, and its objects may well be understood from the name of the society. It meets annually at the same place and time as the larger body, and its meetings have always been full of deep interest for the men actively engaged in street railway work, especially those having to do with the important side of account keeping and cost charging. The fourth annual meeting was called to order Tuesday, October 16, at 10.45 A. M., by President C. N. Duffy, who introduced Mr. Daniel V. Kent, city auditor of Kansas City. Mr. Kent welcomed the association and after a brief response President Duffy delivered his annual address.

He referred to what the association had accomplished, to what it should accomplish and to its present standing. The association, he said, was now on a solid foundation and its membership embraced the representative companies of United States, Canada and Mexico, together with a few companies representing Great Britain. He thanked the American Street Railway Association for its support and cooperation and referred at some length to the standard system of street railway accounting which had been adopted by the convention of railroad commissioners of the United States after its introduction in his association. He spoke of the work of the department of blanks and forms and the committee charged with determining a standard unit of comparison. He earnestly recommended that the association consider the question of formulating standard systems of accounting and units of comparison applicable to the electric lighting and power business. He spoke of the importance of accounting as one of the vital elements of business and recommended the formation of several committees to take charge of the various matters that fall particularly under the head of street railway accounting.

The report of the secretary and treasurer, which was highly gratifying, was then submitted and accepted, and the next order was an address by Mr. John I. Beggs, on "What Does the General Manager Want to Know from the Accounting Department?" Mr. Begg's address was quite long and highly interesting and was received with applause.

Mr. H. J. Davies, of Cleveland, a former active member of the association, then made a short address, after which the report of the committee on standard system of accounting was received. Short addresses were made by Mr. J. H. McGraw, Mr. S. E. Moore and Mr. C. M. Hemingway, after which the session adjourned.

The second day's session was opened by a paper on the "Routine of a Street Railway Electric and Gas Lighting Company," read by Mr. C. O. Simpson, of Augusta, Ga. The paper was discussed by Mr. J. M. Smith, of Toronto, Mr. Tripp, of Seattle, and many others, the discussion extending to considerable length.

The report of the committee on a standard unit of comparison was then received and discussed at great length, nearly all the members taking part in this extended discussion, which occupied the remainder of the day's session.

The third session was opened by a paper on "Departmental Accounts," read by Mr. H. L. Wilson, of Boston. This paper described an elaborate system of account keeping and was followed by a short discussion in which, however, many members took part.

The next paper was entitled "Material and Supplies Account," and was read by Mr. W. M. Barnaby, of Brooklyn. This paper also elicited considerable discussion, after which the nominating committee submitted the list of its nominees for the ensuing year, as follows:

President, William F. Ham, Washington, D. C.; first vice-president, J. A. Harder, Kansas City, Mo.; second vice-president, J. M. Smith, Toronto, Canada; third vice-president, W. G. McDole, Cleveland; secretary and treasurer, W. B. Brockway, New Orleans. The gentlemen were elected as nominated in the usual way, after which various felicitous remarks were made by those present and the association adjourned for another year.

The Electrical Division of the Sound Money Parade in New York City.

From present indications the electrical trades division of the great sound money parade to be held in New York city on Saturday, November 3, will be one of the features of that gigantic celebration and will reflect the highest credit upon the various gentlemen who have given their time and energy to the cause. The name of the association having the electrical section in charge is the Electrical Industries Sound Money Association, of New York city. Mr. E. S. Keefer, of the Western Electric Company, is president; Mr. Allan S. Bakewell is vice-president; Mr. George L. Patterson is treasurer, and Mr. H. B. Kirkland is secretary.

It is believed that the organization will turn out a larger number of men than any other of the trades divisions. To date over 3,000 men have been enlisted as marchers, these representing the various larger industrial establishments connected with the electrical trades in New York city, while there are yet many to hear from and it is thought that this number will be largely exceeded by the day of the parade. Mr. H. L. Shippy, of the John A. Roebling's Sons Company, will be the marshal of the electrical section and the names of his aides will be announced later. The executive committee of the association consists of the officers as named above, Dr. S. S. Wheeler and Messrs. John H. Dale and T. Commerford Martin; the committee on music is Mr. Kirkland; on flags, banners and decorations, Mr. Dale, and on press, Mr. Martin. So far six bands have been secured to enliven the march with music, and of these bands, one, the divisional band, will contain 50 pieces, the others averaging about 40 pieces each. The finance committee consists of Messrs. G. L. Patterson, S. S. Wheeler and James W. Godfrey, and all subscriptions of money toward the celebration should be sent to Mr. George L. Patterson, 32 Frankfort street, New York city. Mr. Littlefield, of the Edison Illuminating Company, will look after the illuminating interests and oversee some of the electrical decorations.

Several of the larger companies propose to turn out in fine style; for example, the Western Electric Sound Money Club, composed of employees of the Western Electric Company, will turn out 1,500 men headed by their own band and under the general direction of Mr. H. S. Albright; the Sprague Electric Company will turn out 400 men with their own band; the Crocker-Wheeler Company will have not less than 500 of its employees in line headed by their own band, and 250 of the employees of the Safety Insulated Wire and Cable Company will turn out also preceded by their own band. All correspondence concerning organizations or individuals who wish to take part in the parade or to aid it in any direction should be addressed to Mr. H. B. Kirkland, 129 Greenwich street, New York city. It will be remembered that upon a similar occasion, four years ago, the electrical section of the parade was classed as a division of the machinery and mechanical trades; this year its importance is so great that it forms a section all by itself and will march independently and present a handsome object lesson of the importance and solidity of the electrical trades in this city.

A New Process For Preserving Railway Ties and Telegraph Poles.

There has lately been erected at Perth Amboy, N. J., a plant for wood preservation according to the Hasselmann process, whereby such classes of timber as railway ties and poles are rendered free from tendency to decompose and greatly increased in life.

The process is one of great simplicity, and the results attained by it are said to be of extraordinary importance, in that the wood, while becoming harder, more durable and apparently changed in chemical composition, nevertheless retains its elasticity and strength, both transverse and longitudinal, and both as regards compression and tension stresses. The process in brief consists of extracting from the wood its sap and other natural juices and of filling its pores with an impregnating liquid which not only serves as a germicide for the destruction of such fungi and spores as it may contain, but which also enters into chemical combination with the cellulose of the wood, producing what is practically a new substance, highly resisting the attacks of oxygen and of the various bacteria which are destructive to ordinary untreated wood. The impregnating solution consists of the sulphates of copper and iron mixed in the proportion of 20 per cent of the former to 80 per cent of the latter, with a proportion of alumina and "kainit," which is a mineral mined at Stassfurt, in Germany, and consisting mainly of the sulphates of potassium and magnesium and chloride of magnesium. The proportion of the salts used, the temperature at which the impregnation is carried on, the time of boiling, as well as the pressure under which it is conducted, all vary with the character, age, nature and general condition of the wood under treatment.

The process is of great interest. There are, in the Perth Amboy plant, a number of horizontal plate-iron cylinders from 100 to 125 feet long and about eight feet in diameter, each being provided with a railroad track in the bottom and a cap which may be bolted on, closing it steam tight. Each cylinder is supplied with jets whereby live steam may be blown in from a boiler. In these tanks the wood, which is supported on skeleton trucks, is covered with the mixture of sulphates in solution and steam is admitted. Boiling is then continued under a pressure of from 30 to 45 pounds per square inch and at a temperature of from 135 to 140 degrees centigrade, the period of boiling varying from two to four hours according to the kind of wood to be treated. The woods of the pine variety require the longest treatment. When the process is finished the steam in the cylinder is blown off through a valve on top and the hot liquid allowed to run to a vat whence it is pumped to be used over again and the timber withdrawn and allowed to cool.

The result is somewhat remarkable in that neither the color nor the fibrous structure of the treated wood is changed, except that in place of the cellulose a horny tough substance has been formed by the combination of the chemicals used with it. This combination is so complete that it is claimed that the chemicals used can not be leached out, and that the chemicals do not crystalize in the cells of the wood with the effect of weakening its structure. After the course of treatment described above it will be found that even in large sticks the chemicals have penetrated completely to the core and that all the sap and deleterious matter has been extracted, leaving the cells and sap ducts free of them, but at the same time not filled with crystals. The process as described is carried on by the Barschall Impregnating Company, New York, and the works at Perth Amboy are busy turning out large quantities of railway ties at present.

It is not known just how long wood so treated will last when buried in the ground or laid on at the surface of the ground and exposed to alternate wettings and dryings. Tests upon wood prepared by the preliminary stages of the process some 20 years ago show that it is still in excellent condition and likely to last certainly as long again. No general figures can be given of the cost of the process, which naturally varies with varying conditions, but it is claimed by its proprietors that this cost is much inferior to the resulting benefit obtained in at least quadrupling the life of wood subjected to it.

The "Electrical Review's" New Offices.

[*From Lightning, London.*]

The New York ELECTRICAL REVIEW gives an illustration of the building in which it has taken new offices. This may be picked out from other and less distinguished houses in Park row by noticing that it is 31 stories high, not counting those in the two towers on top. Our contemporary, however, is only going up 10 stories. The 10 lifts in the building that maintain communication with the surface of the earth are electric, and they and the electric lighting require a plant capacity of 600 kilowatts, or more than one would put in for the whole supply of a decent sized provincial town in England.

A Divided Third-Rail System.

Several points of extraordinary novelty and interest are presented by the new sectional third-rail system of the Bay State Traction Company, a model of which is now on exhibition at the company's offices in New York. The excavation required for the system, it is claimed, is only a ditch 8 by 10 inches in the ground between the two running rails, and in this is contained all of the conductors and mechanism necessary for the system with the exception of heavy feeders.

As described before in the ELECTRICAL REVIEW, the operation of the system depends upon the cross magnetization of an iron or steel third rail which is laid in sections, divided appropriately by insulating material, under each section being small insulating receptacles of mercury in contact with the working conductor. In each of these cups is an iron-headed contact-making device having a projection going down into the mercury and in electrical contact with it. When the car, which carries an electromagnet, passes over a section of the rail this becomes magnetized, attracting the contact closers upward and holding them firmly in place until the car passes, when they fall by their own weight. By this method only the section under each car is connected with the source of current, while those before and behind it are absolutely "dead." A feature of this system which, it is claimed, distinguishes it from all others, is that it employs no springs, switches or other mechanical devices and that it requires the least possible excavation and movement of street surface.

PERSONAL.

Mr. Dwight B. Dean has been appointed sales agent for the J. G. Brill Company, of Philadelphia, manufacturers of street railway cars and trucks.

At the recent annual meeting of the Western Union Telegraph Company, Messrs. E. H. Harriman and Charles Lockhart were elected directors to succeed Collis P. Huntington, deceased, and Alonzo B. Cornell.

Mr. T. E. Crossman, the official stenographer of the American Street Railway Association, deserves several strong words of praise for the swiftness with which he furnished the full verbatim report of the recent meeting at Kansas City.

The marriage of Mr. George H. Walbridge, treasurer of J. G. White & Company, Incorporated, and Miss Mary Gilley, daughter of Mr. and Mrs. James B. Taylor, of New York city, has been announced. The ELECTRICAL REVIEW extends its most cordial felicitations to Mr. and Mrs. Walbridge, who will make their home in New York.

Automobiles

Two Belgian engineers recently took M. Bourgeois, chief of police of the city of Brussels, out in an automobile to explain to him the efficiency of the machine for the police department. It is said that the gentleman was duly impressed and it is thought that the machines will be introduced into the department there.

It has been determined by the common council of Lenox, Mass., that no automobile within the precincts of that town shall run at a speed of more than six miles an hour. This determination is a result of the reckless driving of some of the young and wealthy *chauffeurs* who have amused themselves by sending their machines at terrific speed through the streets without regard to the safety or convenience of pedestrians.

On October 15, while spinning along on Connecticut avenue, in Washington, D. C., the automobile of the Chinese Minister, Mr. Wu Ting Fang, stopped with a sudden jerk, and the temperature of the seat rose so alarmingly that Mr. Wu sprang out. On investigation, the driver found the underbody of the machine on fire, and, though the blaze was extinguished in a few moments, the machinery was so damaged that the minister was compelled to walk to the Legation—and not in the best of humors, either.

Laws have been passed in Switzerland for the operation of automobiles, which state that no machine may be used without having been passed upon by a technical committee on the safety of the vehicle. Its operator must also possess a certificate of competence and each machine must have two lamps, one showing a white and the other a green light, and, most important of all, a plate on which is clearly stamped the name and address of the proprietor must be displayed in a prominent place upon the body of the vehicle. The one feature of the laws which is considered strange is that they do not touch at all upon the question of speed.

Contests of a very interesting nature will be held during the Automobile Show, in Madison Square Garden, New York, during the coming exhibition in November. The utility of the machine will be thoroughly tested and the contests are designed to show the facility with which an experienced driver can extricate his machine from seemingly insurmountable difficulties. The programme, which is under the direction of the technical committee, is as follows:

Saturday, November 3—Evening, 45 minutes, obstacle contest for steam vehicles.

Monday, November 5—Afternoon, 45 minutes, brake contest for electric vehicles; evening, 45 minutes, obstacle contest for electric vehicles.

Tuesday, November 6—Afternoon, 45 minutes, brake contest for gasoline vehicles; evening, 45 minutes, obstacle contest for gasoline vehicles.

Wednesday, November 7—Afternoon, 45 minutes, brake contest for steam vehicles; evening, 45 minutes, obstacle contest for steam vehicles.

Thursday, November 8—Afternoon, 45 minutes, brake contest for electric vehicles; evening, 45 minutes, obstacle contest for electric vehicles.

Friday, November 9—Afternoon, 45 minutes, obstacle contest between operators of electric cars for hire, also stopping contest; evening, 45 minutes, competition of electric delivery wagons, obstacle contest and stopping competition.

Saturday, November 10—Afternoon, 45 minutes, championship competition and obstacle contest between winners in steam, electric and gasoline; evening 45 minutes, championship between winners of stopping competition in steam, electric and gasoline.

The Electric Vehicle Company's Factory.

With the exception of a very small portion of the present plant, the factory of the Electric Vehicle Company, at Hartford, Ct., was built especially and exclusively for the manufacture of automobiles. Provision was made not only for carrying on the machine work and assembling, under the most modern conditions as regards lighting, ventilation and floor space, but the requirements of the carriage painter and finisher were also borne in mind. In the illustrations shown herewith, the three stories of the part directly behind the office were formerly occupied for other purposes. The fourth story of this building, as well as the remainder of the enormous plant, were all erected with the peculiar requirements of the automobile industry in mind.

An upright Slater engine of 350 horsepower drives part of the shafting through a rope transmission. Two Siemens & Halske generators, each of 125 kilowatts capacity, furnish the current for lighting, and also furnish current for a number of motors which are used in connection with individual machine tools, and are also, in certain divisions of the factory, used exclusively for furnishing all the power.

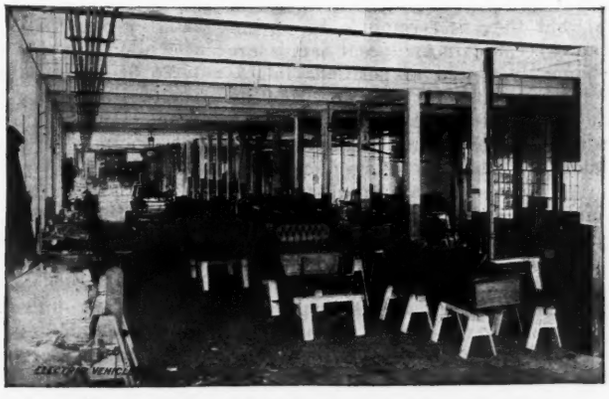
The general machine work, the assembling of the controllers, and of the motors into their casings, is done on the two middle floors of the older portion. On the ground floor of this part, the motors are also tested upon their receipt from the makers. The motors themselves are not manufactured by the Electric Vehicle Company, but are bought in the outside market, to somewhat rigorous specifications. Before each one is accepted for automobile use, it is subjected to a severe brake test to determine its efficiency and overwork-resisting qualities. On the ground floor of this same part of the building, are also located the battery assembling and testing rooms.

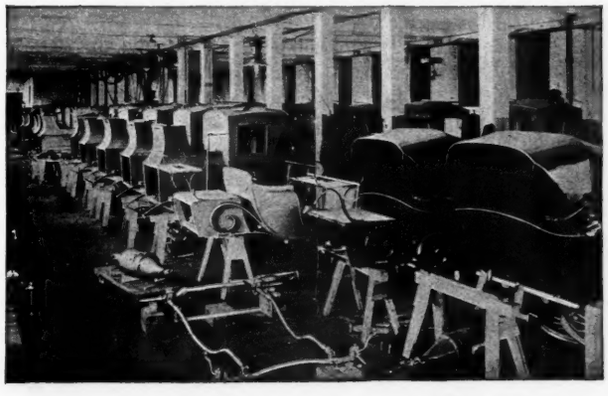
On the fourth floor is found the drafting room, where some 40 engineers and draughtsmen have the advantage of excellent light and ample space. On this same floor is also situated the model room. It is the practice of the company to build here, under the direct supervision of the engineer corps, the first ones of any new lot of vehicles before their active manufacture is begun. It is not until the models thus produced have been thoroughly tested and accepted, that their manufacture in large numbers is turned over to the production department. This principle is a novel one to constructors of horse-drawn carriages, although it has been adopted by manufacturers of fire-arms, and of other high-class mechanical products. It is claimed that it may be considered an exceptional assurance to the purchaser of a Columbia automobile, that every feature of any vehicle sent out from the factory is the result of the survival of the fittest. On this same top floor are located the wood-working department and the pattern room.

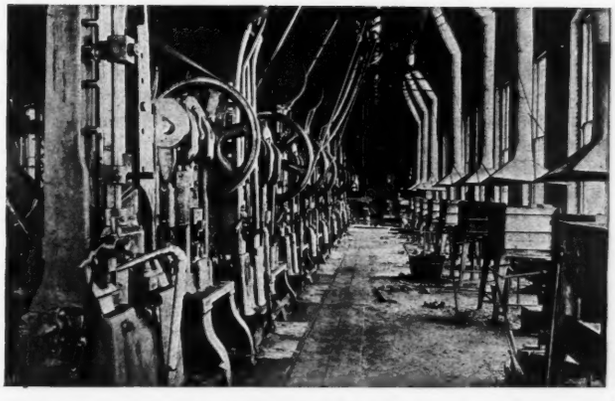
In the north and northwest extensions on the top floors are the painting and finishing rooms. The carriage finishers here have the benefit of a northern light, which is, of course, prized by all artists. There is no machinery over their heads, and no possibility of dust, even in the most minute particles, sifting through onto their work. The rooms where this is done are also kept carefully shut, with the same object in view, that of insuring against dust. The washing and rubbing stands are also located on these same top floors.

To those not familiar with carriage-finishing work, the amount of time this consumes is invariably a surprise. When the bodies are received from the body builders, they are merely in the priming, which usually consists of a coat of oil and a coat of lead. There are then applied from 13 to 15 different coats, beginning with lead and rough stuff and ending up with the finish varnish. The rough stuff acts, of course,

as a filler, and after half a dozen coats of this material, the body is carefully rubbed down. Then after standing for a proper length of time the color is applied in from two to three coats. Then comes the rubbing varnish in an equal or greater number of coats, and, at the end, the finish varnish. The entire operation should properly consume from five to eight weeks, or longer. In order to handle the bodies as they are passing through the different departments, they are placed on large trucks, especially designed, which are shoved along a track in the centre of the floor. Elevators of sufficient dimensions







Views in the Manufacturing Plant of the Electric Vehicle Company, Hartford, Ct.

to take even the largest omnibuses are provided at each end of the northwest building, to facilitate the transferring.

On the lower floors of the northwest wings are located the gear and wheel painting rooms, and there also is done the assembling of the gears onto the bodies, as well as the trimming and upholstery. Finally, on the ground story, are found the storerooms and shipping rooms.

The forge shops are located in separate buildings at the rear. As far as practicable, the forging is done by power hammers, and under large drops, some of which weigh over a ton. Here the axles and other heavy fittings, such as the steering pivots, are forged from steel carefully selected for the work in view. There are in all 10 drop hammers, besides an assortment of steam and other power hammers. In carriage work, however, there are a large number of parts which can only be advantageously forged by hand, and a considerable section of the forge shops is set off for this class of work.

Of course, the larger proportion of the machine work and the forge shop work is done by the piece, and the workmen are paid accordingly. Every piece is carefully inspected and tested before it goes to the assembling room.

Another test comes when the vehicle has been assembled and set up, before, however, the final coats of finish are applied to the body. Every effort is made, in this test, to develop whatever weakness may possibly have crept into the construction of the vehicle, and which can not always be foreseen. The test is made over typical country and city roads, and includes also obstructions as high as the ordinary curb stone.

Over one thousand electric automobiles of the different styles manufactured have been shipped to date from the Columbia factories. They are in use in all the principal cities of the United States, in the Hawaiian Islands, in Mexico and Canada. Paris has over 80 of these vehicles, while Berlin, London and Madrid have each a fair number. Their continued successful use in these widely separated localities is a most satisfactory testimonial to the thoroughness of the testing done in the Hartford factory.

The storage batteries, the vehicle bodies, and the wooden wheels are not built at the main factory. The batteries come from the Electric Storage Battery Company, of Philadelphia, being assembled and placed in their trays in Hartford, although in many cases they are shipped unassembled to some of the larger customers who possess their own facilities for this assembling.

The bodies and the wooden wheels are built in a separate factory. This is equipped with all modern appliances for handling work of this class, including heavy hydraulic machinery for the manufacture of the wheels.

All of the Electric Vehicle Company's factories are built and equipped with a view to the comfort of the working men employed. There are large and commodious wash rooms, where a locker is provided for each employee. A lunch room and smoking room are also in the building.

The location of the factory itself is worthy of comment. It is at the edge of Hartford's enormous park system, and the surroundings are more attractive than frequently associated with manufacturing plants. The New York, New Haven & Hartford Railroad runs along the western boundary of the Electric Vehicle Company's property, and a spur track is connected with the shipping department.

MISTAKES IN THE RATING OF INCANDESCENT LAMPS.

BY PROFESSOR ARTHUR J. ROWLAND.

(Continued from page 408.)

Earlier it has been pretty thoroughly explained that the only sensible candle-power by which to call an incandescent lamp is that which is useful in producing illumination at desired points. Such a method has never been used in marking incandescent lamps for sale. It is strange how precedent binds us in everything we do. Here in the matter of incandescent lamp candle-power we are all tied to methods of designation which look back to photometric methods used for gas burners. True, mean spherical candle-power and rotation methods are distinctively electrical, but they first came to be of importance because incandescent lamps are so commonly placed in positions impossible to gas burners; and the rotation methods are used simply to save time in measurement, one reading taking the place of a dozen. It has already been explained that the mean spherical candle-power is an impossible measurement for commercial purposes. Rotation methods are poor, too. Not only does the speed of rotation affect the result procured, but some of the best modern lamps produce such a flicker at the car of the photometer when rotated at standard speed (180 revolutions) that not only is the making of an observation most trying to the eyes, but the observer can only make a rough guess for the position of his screen when a balance is obtained. A recent suggestion to choose such a speed for each lamp as just removes the flicker is impractical, also, for not only does it require an adjustment of speed with different lamps, but with many filaments high speed of rotation distorts the filament or even throws it against the glass, due to centrifugal forces brought into operation by the high speed.

What more rational, then, than to measure the lamp's candle-power looking in at the end? It is the light coming from the end which we make use of—which we are interested in. Then this is the light to measure, and that by which the lamp should be rated. Lamps measured thus are as comparable with each other as lamps measured any other way. The apparatus required to make the measurement would be very simple, for no rotating device would be required and the lamp need only be inserted in the socket without any care as to which side comes uppermost when its candle-power is determined, since the candle-power must always be read the same. Thus, readings of different observers would agree without respect to anything involved in the measurement, except the standards used and the personal element, which never can be eliminated. Such a radical change of method, however sensible the change, could not be made without the sanction and support of some of the large associations of electrical engineers. In the meantime, however, for eventually this method must certainly come to be used, all lamp users should, in addition to a measurement of candle-power in the conventional way to check up the lamps purchased, take a reading of the useful light out from the tip.

A 16 candle-power lamp should be one giving 16 candle-power from the tipped end. The horizontal candle-power might be considerably less and be irregular in different directions without altering the real value of the lamp. An ideal 16 candle-power lamp would perhaps be one which measures 16 candle-power from the tipped end, had 16 candle-power as the mean horizontal candle-power, and was of nearly 16 candle-power mean spherical. Such a lamp could be turned into any position in an electrolier and still give an illumination equally as good as before and as well distributed.

In most lighting, also, the end of the lamp which has been called the tipped end all along should be tipless. Hold a piece of white paper below an ordinary tipped lamp, hung with the tip down, as it commonly is, and the reason is unnecessary to state. Variations in thickness of glass and shadow cast by the tip make lines of light and shade that spoil all real value of light procured.

Since the making of such lamps as these is doubtless but a choice of filament form and arrangement, let us hope it will not be long until there are some ideal lamps available commercially.

So far no word as to the efficiency of lamps has been said. It does not directly affect the candle-power nor distribution of candle-power. All the lamps mentioned above, for instance, were 3.5-watt 16 candle-power lamps. But why are they 3.5 watts per candle-power? Each lamp used burned with a consumption of 56 watts. The efficiency of watts per candle-power is strikingly varied by the candle-power to which reference is made. In Fig. 10 are set down the efficiencies of each lamp of the five types, calculated on the basis of the candle-power values in Fig. 9. A 3.5-watt lamp turns out to be one which uses this much electric power per candle-power if this is reckoned at its highest value, the mean horizontal. What a terrible inefficiency these lamps have if we calculate the watts per candle-power from the useful light or the light from their tips.

It is interesting to notice, in these plots of illumination, that after the 45-degree ray is passed the value of all types of filaments is about the same; and it should be noted that the illumination procured is very small. An illumination of one-tenth of a candle-foot, for example, is that which one receives on a piece of paper held vertically more than three feet from an ordinary candle. Such light as passes out from a lamp in directions nearly horizontal or above the horizontal plane is useless except it is reflected back to the surfaces to be lighted or contributes to the general illumination by dispelling the gloom of the upper parts of a room and by giving a diffused character to the light. While it has such value, it is rarely that one can afford to use much light this way. If light is useful after reflection, it must travel in long paths; so that even if it reaches points where it is useful, so little illumination is produced that direct light is much the best. A very white surface will not reflect more than 85 per cent of the light which strikes it, while dark walls and ceilings and hangings reflect almost no light at all. The item of reflected light is then one of very uncertain amount at most. Take a room in which the ceiling is only 12 feet high, in which a 16 candle-power lamp hangs four feet from the ceiling, and one finds that no rays from any lamp now made, passing out to reach the ceiling or wall above the horizontal plane through the feet below the lamp, even on the assumption that the ceiling and wall are the best possible reflectors.

(To be concluded.)

A Suggested Automobile Improvement.

To the Editor of Electrical Review:

Noticing an article in your issue of October 10, regarding a new light electric runabout, the writer has been moved to criticise the general make-up of these machines. In appearance, they look very neat, especially the cut showing two occupying one seat. Can not some one conceive an idea whereby the operating lever can be operated by the outside hand, thus leaving the inner arm free for other "duties?" Or will not some one scheme to have the machine operated by foot levers, thus permitting the gentlemen the free use of both arms? Outside the question of price (with me) this is a most important factor of a ride.

Frank C. Austin.

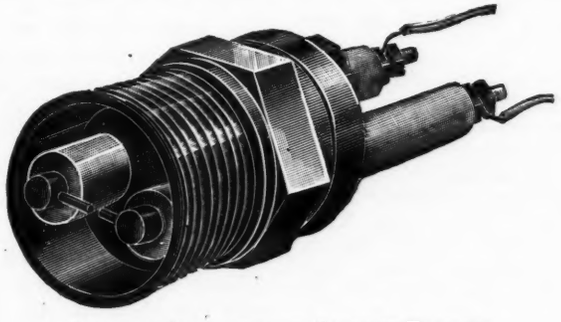
Pittsburgh, Pa., October 20.

Electricity Destroys Water Mains.

The water board of St. Paul, Minn., has recently had its attention called to the condition of the water mains to which electric wires were attached. A leak was discovered in the city and workmen were sent to make repairs. On digging down they found one of the street car company's wires wrapped around the meter. One of the men who happened to touch the box was knocked down and badly shocked by the current. After considerable delay and much hesitancy on the part of the men the wire was cut and it was then found that the electricity had melted the pipe around the brass shut-off cock, and the water was gushing through the opening in a considerable stream. Other superintendents report that the traction companies in many cases use the water mains to carry the return current back to the power house, as they supply a very cheap conductor. The board's workmen have shown considerable fear in handling the repair work, and there is no little feeling regarding the matter.

Sparking Apparatus for Gasoline Engines.

The instrument shown in the accompanying illustration is particularly adapted to automobiles and other apparatus using small gas engines. It is also serviceable for large gas engines. The apparatus is constructed with sparking-plug insulation on both sides of the circuit, which prevents the liability of short circuits and does away with the likelihood of any failure in connection. In the igniting apparatus, the two metal points, set in the leading end conductors, are made of solid platinum and the rods to which they are attached are made of steel. The plug insulation is a porcelain tube, lined with asbestos, and the steel rods fit tightly within this lining and are held in place by a head at one end and with lock nuts at the other. A small vibrating induction coil is used in connection with the device and a battery of four cells is placed in the lower part of the apparatus, which is



Sparking Apparatus for Gasoline Engines.

entirely sufficient for generating a current. The battery cells connected in circuits are placed in a box. When the apparatus is started, four cells are connected with the primary of the induction coil, and, as the cells are used up, the connection can be so changed as to include more cells.

The dry cell used in connection with this igniter is of the well-known standard make, and has proven itself to be one of the best dry cells on the market to-day. A vibrating insulated key, which can be applied to any type of engine, makes the circuit of the igniter and it can be operated by an attachment to the shaft of the engine, thereby allowing the engineer to obtain a spark at any point of the stroke. The batteries are enclosed in a handsome wooden box, which will hold eight cells. The device was invented and is manufactured solely by William Roche, who states that it has been successfully applied to a great number of gas engines.

It is necessary, when using this apparatus, to keep the wires from the secondary post coil to the spark plug at least one inch apart, and also one inch from the frame of the engine. The apparatus is built by William Roche, 42 Vesey street, New York city.

The Federal Telephone Company.

To the Editor of Electrical Review:

It may interest certain of your advertisers who are regularly sending out circulars, catalogues and other printed matter to learn that the purchasing of all supplies for the Federal Telephone exchanges in the following-named towns in Pennsylvania is taken care of at the general offices of the company, in the Bissell Block, Pittsburgh, Pa.:

Aliquippa, Avonmore, Belle Vernon, Bellevue, California, Coraopolis, Carnegie, Canonsburg, Charleroi, Esplen, Etna, Emsworth, Elizabeth, Elliot, Freeport, Fayette City, Freedom, Glenfield, Irwin, Latrobe, Leechburg, Millvale, Monessen, McKeesport, Monongahela City, New Kensington, Oakmont & Verona (now under construction), Pitcairn, Wilkinsburg, Wilmerding, Sewickley.

It may also be of interest to note that the following-named telephone companies recorded in the directory of the National Telephone Association have all been absorbed by the Federal Telephone Company, and all correspondence for these companies should be sent to Bissell Block, Pittsburgh, Pa.:

Elizabeth Telephone Company, Elizabeth, Pa.; Carnegie Telephone Company, Carnegie, Pa.; Latrobe Telephone Company, Latrobe, Pa.; McKeesport Telephone Company, McKeesport, Pa.; Washington County Telephone Company, Washington, Pa.; Washington Telephone Company, Washington, Pa.; Kiskiminetas Valley Telephone Company, Apollo, Pa.; Pennsylvania Telegraph and Telephone Company, Beaver Falls, Pa.; Ewing Telephone Company, Avonmore, Pa.; Home Telephone Company, Cecil, Pa.; Home Mutual Telephone Company, Canonsburg, Pa.; Home Mutual Telephone Company, Houstonville, Pa.; Local Telephone Company, Leechburg, Pa.; Home Mutual Telephone Company, McDonald, Pa.; Home Mutual Telephone Company, Venice, Pa.; Mutual Home Telephone Company, Washington, Pa.; Youngstown Telephone Company, Youngstown, Pa.; Coraopolis Telephone Company, Coraopolis, Pa.; Sewickley Telephone Company, Sewickley, Pa.

Federal Telephone Company,
Fred De Land, President.

Pittsburgh, October 19.

Wall Street and the Electrical Stock Market.

As is shown by the following quotations, the stock market continues to advance, and speculation is notably active. This is due in a great measure to the political question of the day, and consequently speculation in securities and the business of the country is conducted with regard to this issue.

On the New York Stock Exchange, General Electric closed the week at 142¼ bid and 143¼ asked, showing a gain of 1⅞ points. Metropolitan Street Railway, of New York, closed at 156¾ bid and 157 asked, indicating a gain of 6¾ points for the week, or a gain of 8½ points for two weeks. Third Avenue Railroad, of New York, was not quoted. Brooklyn Rapid Transit closed at 56½ bid and 56⅝ asked, showing a gain of 3⅞ points for the week. Manhattan Railway, of New York, closed at 97⅞ bid and 98 asked, showing a gain of 5⅝ points for the week, or a gain of 7⅛ points for the last two weeks.

On the Boston exchange, American Telephone and Telegraph closed at 144 bid and 145 asked, showing a gain of 3 points for the week and 6 points for the two weeks.

Erie Telephone closed at 95½ bid and 96 asked, indicating no change in the bid price and a loss of ½ point in the asked price.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Electric Company of America closed at 9⅝ bid and 9¾ asked, showing a gain of ⅝ point. Union Traction closed at 33½ bid and 33¾ asked, indicating no change for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 23½ bid and 25 asked, showing a gain of 8½ points for the week. Electric Boat closed at 18 bid and 20 asked, showing a gain of 5 points for the week.

Wall street, October 20.

Engines for the Boston Elevated Railway Company.

The Boston Elevated Railway Company, of Boston, Mass., has asked for bids for a vertical engine to be direct coupled to a 3,000-kilowatt generator.

Corporation News

FLORENCE, COLO. — Local capitalists have incorporated an electric street railway company for $500,000.

ANDOVER, OHIO—The Andover Electric Company has been incorporated by local capital for $6,000

WEST NEW BRIGHTON, S. I.—The Auto-Electric Shunt Company has been incorporated, with $5,000 capital, by local interests.

SANTE FE, N. M.—Work is begun on the Sante Fe Street Railway Company, which has recently been incorporated for $250,000.

GUTHRIE, OKLA. TER.—A recent incorporation is the Washita Valley Telephone Company, whose headquarters will be at Mountain View.

RUSSELLVILLE, IND.—C. H. Ramsay, Leonard Wilson and W. C. Boyd have incorporated the Starlin Telephone Company with a capital of $192,000.

ROACHDALE, IND. — Local capitalists have incorporated the Roachdale Union Telephone Company for $100,000, and active operations will soon be begun.

DENVER, COLO.—Delos A. Campbell, J. A. Kebler, J. L. Jerome and J. C. Osgood, all of Denver, have recently incorporated the Mountain Telegraph Company for $1,000,000.

INDIANAPOLIS, IND.—The Indiana & Ohio Traction Company has been incorporated for $750,000 to build an electric road between the cities of Mation and Hicksville, in Ohio.

WABASH, IND.—A bond for the sum of $10,000 has been filed by the Wabash River Traction Company to begin construction work on the interurban road from Wheeling to Peru.

CHATSWORTH, ILL.—Officials of the Peoria & Eastern Automatic Telephone Company have changed its name to the Peoria & Eastern Telephone Company and increased its capital stock from $12,000 to $25,000.

CHARLESTOWN, W. VA.—Articles of incorporation have been issued to the Wheeling Traction Company, which has been capitalized at $10,000 and will construct a street railway from Wheeling to Bridgeport and other towns in Ohio.

COLUMBUS, OHIO — Local capitalists have incorporated the Dayton-Maysville Electric Railway Company, of Morrow, at $10,000. It is proposed to construct a line from Dayton to Aberdeen along the banks of the Ohio River.

ALBANY, N. Y.—Certificates of the extension of the lines of the Amsterdam Street Railway Company and the Yonkers Railroad Company have been filed with the Secretary of State. The Amsterdam lines will run only over private property.

ALBANY, N. Y.—The Albany County Railroad Company has been incorporated to build an electric railway three-quarters of a mile long in the city. The capital stock is $20,000, and the directors are nearly all interested in the General Electric Company, of Schenectady, N. Y.

COLUMBUS, OHIO—The Toledo, Ohio, Interurban Railway Company was recently incorporated, with a capital stock of $100,000, by local men and will run northwest from Toledo through Lucas, Fulton and Williams Counties, crossing the state line in the last named.

WARREN, OHIO—The Economy Electric Company has been incorporated by P. L. Webb, George H. Jones, George B. Sawyer, J. W. Powers and H. W. Smith, Jr. They will make dynamos, insulators, motors and electric supplies of all kinds. The capital stock is $50,000.

CLYDE, N. Y.—The rights, franchise and all the holdings of the Clyde Gas and Electric Company have been sold, for a consideration of $865, to Edward Moir, of Marcelles. Besides the property he will get a bond and mortgage of $25,000, but all that the stockholders will realize from the sale is a division of the cash paid.

SANDUSKY, OHIO—The Citizens' Electric Light and Power Company, which was recently incorporated with a capital stock of $100,000, will compete with the old company. Among the incorporators who are interested in the Sandusky & Interurban Railway Company are: J. B. Hanna, H. A. Everett, Barney Mahler, W. H. Price, George A. Stanley, Jas. Hoge, C. H. Stewart and Charles Wason.

COLUMBUS, OHIO—The board of decennial appraisers has notified the officers of the Columbus, Ohio, Street Railway Company that it has decided to list its city trackage at $10,000 per mile. The company owns 76 miles of tracks within the corporate limits, and the total taxable valuation will therefore be $760,000, in addition to which its personal property was placed on the tax duplicate some time ago at a valuation of $1,250,000.

CHARLESTON, W. VA.—Articles of incorporation have been filed for the Wheeling Traction Company, with a capital stock of $10,000. The incorporators are: A. M. Snyder, F. A. Henry, A. R. Manning and L. M. Hilreth, all of Cleveland. The company proposes to construct and operate an electric railway in Wheeling, W. Va., Bellaire, Bridgeport, and Martin's Ferry, Ohio, and in other adjacent Ohio towns.

COLUMBUS, OHIO—The Ohio state board of appraisers has completed the valuation of the property of telephone companies for taxation, and, as a result, several million dollars have been added to the tax duplicate. The valuations placed on the larger companies are as follows: Central District and Printing Telegraph Company, $264,537; in 1899, $147,637. Central Union Telephone Company, of Columbus, $1,853,476; in 1899, $1,127,588. United States Telephone Company, Cleveland (independent, long-distance system), $324,987; in 1899, $41,960. City & Suburban Telephone Association, Cincinnati, $743,179; in 1899, $9,673,038. Cleveland Telephone Company, $1,064,896; in 1899, $708,022. Cuyahoga Telephone Company, $505,000; in 1899, $224,000. Ohio Telephone Company, $541,781; in 1899, $433,872. The Newark Company is appraised at $10,115, as against $1,904 last year, and Chillicothe, $19,000, as against $2,716 last year. The Napoleon Company is put on for the following years it failed to report: 1897, $3,600; 1898, $5,000; 1899, $5,000; 1900, $6,350.

Electrical Inspection in New York.

For some time past electrical engineers and contractors have been discussing the rumored illegality of the inspections and rules of the department of public buildings, lighting and supplies of the city of New York. As the matter has aroused considerable feeling in electrical circles and the majority of those to whom the matter is of importance, a brief statement of the facts of the case will be of interest.

The rumor was to the effect that the rules of the department were illegal, as they had not been passed upon by the proper authorities, whose approval was necessary to make them statutes; that the inspections, under these rules, were null and could not be enforced; that violations of the rules had never been punished, etc.

These statements have just sufficient truth in them to be plausible and be given credence by those who are not familiar with the workings of the city government. When the new charter went into effect, all the old organizations and institutions "for the public weal and safety" were left undisturbed and continued in power, no abrogation of their authority being even considered. Among these was the department of public buildings, lighting and supplies, whose commissioner has power to issue proper rules for the conducting of inspections and all matters relating to his work. While these have not, as yet, become statutes in the formal sense, they have passed three or four readings and are to be approved when the proper time comes for such action.

As to the punishments, none have ever been inflicted because, until the rules of the department become recognized ordinances, there can be no punishment. But until the violation is taken off by the local inspector no electric light or power company in the city will turn on the current.

Taken altogether, it is as foolish and groundless a rumor as has ever been circulated among electrical men, and it seems strange that otherwise intelligent persons should credit such a laxity and sloven carelessness in our city government as was indicated by the report.

Annual Report of the Boston Edison Company.

The directors submit herewith a condensed balance sheet, showing the condition of this company on June 30, 1900.

The number of lamps connected to the company's circuits, as compared with the previous four years, is shown in the following table:

Incandescent lamps connected June 30,	1896	114,354
" " " " "	1897	138,682
" " " " "	1898	161,466
" " " " "	1899	183,165
" " " " "	1900	211,471
Arc lamps connected	1896	1,112
" " " " "	1897	1,446
" " " " "	1898	1,486
" " " " "	1899	1,791
" " " " "	1900	2,131
Motors connected, June 30,	1896 horse-power,	5,131
" " " "	1897 " "	5,675
" " " "	1898 " "	6,473
" " " "	1899 " "	7,504
" " " "	1900 " "	9,428

The station earnings and expenses for the year are as follows:

Gross earnings	$1,131,758 56
Expenses	725,537.09
Net	$406,221.47

CONDENSED BALANCE SHEET, JUNE 30, 1900.

Dr.		
To Installation	$4,259,601.87	
Unfinished installation	239,929.21	
		$4,499,531.08
Liverpool wharf estate		235,912.05
Cash on hand		141,997 67
Stock on hand		43,844.69
Notes receivable	$36,598 55	
Accounts receivable	78,107.13	
		114,705.68
		$5,025,991.17

Cr.		
By capital stock	$3,920,000.00	
Instalments on new stock	161,735.00	
		$4,081,735.00
Trust mortgage bonds		180,000.00
Accounts payable	$29,531.50	
Notes payable	100,000.00	
Unpaid dividend, due August 1, 1900	78,400.00	
		207,931.50
Sundry open accounts		2,,903.11
Reserve for maintenance	$432,000.00	
Premium on new stock	40,660 00	
Profit and loss	62,761 56	
		535,421.56
		$5,025,991 17

E. and O. E.
BOSTON, June 30, 1900.

RAYMOND APOLLONIO, Treasurer.

The petition referred to in the last annual report for the right to increase the capital stock of your company was granted by the board of gas and electric light commissioners, and permission was given to issue 4,000 shares of new capital stock at $175 per share. This stock was all subscribed for, and certificates were issued early in August.

The extensions on your Atlantic avenue property, referred to last year, are now under way, and it is expected to place the new buildings in commission by January 1 of the coming year. Two 2,500 horse-power engines, dynamos and accompanying boilers have been purchased and will be in operation at the same time. There will still remain sufficient room in the completed buildings for the installation of 15,000 to 20,000 horse-power, which should take care of the company's growth for some years to come.

The new district in South Boston, which has grown up around the Congress street extension, has for some years been supplied by a submarine cable. It has seemed desirable, during the past year, to supplement this with a storage battery, and a lot of land was obtained on a 25-year lease, and a small brick building, with its storage battery equipment, was erected and is now in operation.

Per order of the board of directors,
C. L. EDGAR, President.

An Electric Census Machine.

The census bureau, at Washington, D. C., has recently put in electrical machines for compiling the census returns which will do away, to a great extent, with the work of the "punchers." Under the old régime the clerks, mostly women, could only fill up the cards on which the returns are made at a slow speed, but with these new machines it is estimated that each one will be able to fill 1,400 cards a day. When the cards leave the punching clerks, they are verified and sent to the electric tabulating machine, which is ingeniously constructed and self-feeding. After having passed through the tabulating machine, where all the information on the enumerators' cards is recorded, they are fed into a circuit controlling device by means of which any desired combinations of facts may be obtained; but if a mistake has been made in punching the card, a bell at the side of the machine refuses to ring, the card being thrown out to be corrected. It is estimated by the officials of the census bureau that these machines will complete the tabulation in November, an undertaking which, without them and the clerks to operate them, could not have been done inside of five years.

Lectures for Electricians.

A course of 10 lectures will be given at the New York Trade School, First avenue and Sixty-seventh to Sixty-eighth streets, beginning on November 2 and extending to March 15, 1901. Their object will be to help the journeyman electrician to deal with problems of daily occurrence, practical demonstrations of which will be given. The lectures begin at 8 P. M.

Electric Coke Mining.

In Connellsville, Pa., is situated one of the greatest coke industries in the world, and a departure will be made from the recognized methods of mining the coal which will do away to a great extent with the inconvenience to which the inhabitants of the town have been subjected by the smoke. The coke smoke itself pours in a heavy, dense mass from the chimneys and is not only disagreeable to the eye and olfactories but is of considerable detriment to the farmers.

It is intended by the owners of the mines to substitute electricity entirely for the old methods, and it is expected that from the pit mouth to the oven the coal will be handled entirely by electrical apparatus, thus doing away with the mules and many of the men. Electric mining machines will dig out the coal, electric motors will haul it to the bottom of the shaft and electric lifts will hoist it to the tipples and dump it into the larries. In the construction of the big plants, wood has been almost entirely eliminated and iron and steel have replaced it in the construction, being used on the shaft and slope tipples, as well as the trestle work.

The acreage of the coal field consists of about 40,000 acres, in which there is room for about 10,000 coke ovens as the plants are now laid out, 4,000 of which are under construction and about one-quarter of that number expect to be making coke this year. The installation of electric appliances in the mines will, it is expected, mean a saving of considerable value to the operators in the handling of both crude and finished products and the coke delivered at the oven mouth will be lower in price than ever before.

Bids for Mysore Plant.

Another Indian state has fallen into line and is contemplating the purchase of an extensive power plant for use in connection with the gold mines in its territory.

The state concerned is Mysore, whose government has called for bids from several engineering firms for the machinery and apparatus necessary to equip a large power plant to be run by water at Canvery Falls. After the current is generated at the falls it will be conveyed about 100 miles to the mines, where it will be utilized to operate drills, pumping, hoisting, dumping and other complex mine machinery.

It is stated that after the company which obtains the order makes delivery it will have no further expense or responsibility, as the state government will assume all charges of installation, which will be placed in the hands of its own engineers, most of whom are Englishmen.

Industrial Notes

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out quotations showing a reduction in price on iron box bells.

THE CRANE COMPANY, of New York city, has issued a neat wall plaque in nine colors illustrative of its valves, showing one in operation.

MR. JOHN T. McROY, of New York and Chicago, has just issued his regular monthly calendar blotter, illustrating and describing the McRoy multiple duct conduit.

THE FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY, Chicago, has received a bronze medal for its exhibit in the department of electricity at the Paris Exposition.

THE C. W. HUNT COMPANY, of West New Brighton, S. I., has issued its circular of electric locomotives for light railways, claiming simplicity, convenience and economy for their machines.

FRED M. LOCKE, of Victor, N. Y., announces that E. R. Reed & Company, of Denver, Colorado, has been made his selling agent for the western territory. The new agent will carry full lines of samples and handle all business formerly taken care of from the head office.

M. LANCE & SONS, Twenty-ninth and Carson streets, Pittsburgh, Pa., have issued a catalogue showing a complete line of their bolts, nuts, hinges, washers, etc. The catalogue contains a revised price list of all articles manufactured by the company and described in the catalogue.

IVAN M. JOHANSEN, formerly of Sweden, has accepted the position of superintendent with the General Incandescent Lamp Company, of Cleveland, Ohio. Mr. Johansen was connected with the De Lavals Glodlampfabrik Swea, of Sweden, and the Beacon and Columbia lamp companies in this country.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has been compelled to add an extra force of employés owing to the large rush of Fall business. The company is now running its plant at a very high capacity and is sending out large quantities of its well-known dynamos and motors.

PHILLIPS INSULATED WIRE COMPANY, Pawtucket, R. I., has been recently installing large quantities of its well-known "O. K." weather-proof wire. The company announces that there has been an increased demand for this wire throughout the field during the past six months and the factory is taxed to its utmost to fill the incoming orders.

J. E. RHOADS & SONS, of Philadelphia, Pa., manufacturers of leather belting and jobbers in rubber goods, have issued their Fall catalogue, an illustrated book of attractive appearance, well calculated to show off their goods to the best advantage. A cipher code for telegraphic orders is included in the back of the book; all items are marked with full prices.

CENTRAL STATIONS and construction companies have more or less demand for fixtures. The Western Electric Company, Chicago, has a large assortment of portables, brackets, stationary and adjustable fixtures to meet this demand. A 150-page fixture catalogue, just issued, illustrates these goods in a very comprehensive manner and will be sent on request.

M. I. VOUGHT, La Crosse, Wis., has issued a neat folder with good cuts illustrating his adjustable two-ball hanger for incandescent lamps. The construction is simplicity itself, there being nothing in the balls but a vulcanized fibre pulley wheel over which runs the supporting chain, and the lamp may be held at any height as the balls balance each other in weight.

THE ELECTRIC FAN MOTOR manufacturers of the United States are busily preparing fans for the season of 1901, which promises to be even a larger one in the fan motor field than that of 1900, which was an unprecedented one. The American manufacturers in that line are shipping large quantities of fans abroad each season. Fans of American make seem to be more desirable in foreign countries than other types.

THE L. B. ALLEN COMPANY, Incorporated, Chicago, reports a very large increase in the demand for its specialties the Allen soldering stick, the Allen soldering paste, Allen's soldering salts. The paste, which the company has not, until recently, placed upon the market in small-sized packages, has more than justified expectations. It has proven itself a valuable addition to the well-known "duo," meeting approval on every hand.

THE AMERICAN BLOWER COMPANY, Detroit, Mich., is sending out to the trade a very attractive catalogue showing its blower systems. The catalogue is printed in three colors, and is profusely illustrated with half-tone engravings of different apparatus manufactured by this company. Special notice is made of its "A B C" dry kilns. The catalogue also contains a number of highly complimentary testimonials of leading firms throughout the country who are using this apparatus.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., has shipped a large quantity of its well-known dynamo and motor brushes, which have attained considerable eminence throughout the dynamo and motor field for their non-sparking quality. The increase of orders during the past few months has been unprecedented. The company is also sending out large quantities of its commutator compound, which has been successfully tried throughout the United States and foreign countries

THE BROOKLYN, N. Y., INSTITUTE OF ARTS AND SCIENCES has issued its customary prospectus for the academic year of 1900-1901. Among the courses as outlined in the handbook are the following lectures, many of them by men prominent in their respective professions: Astronomy, Garrett P. Serviss; Russian Life and Literature, Prince Kropotkin; Electricity, Professors Geyer, Fessenden, Hopkins, Pupin and Crocker. The courses in law, physics, mathematics, botany, geology, etc., will all be handled by men of ability, and the institution looks forward to a successful year.

THE ORIENT ELECTRIC COMPANY, and the Colonial Electric Manufacturing Company, manufacturers of incandescent lamps announce their consolidation. The consolidated companies will hereafter be known as the Colonial Electric Company and will manufacture the well-known "Orient" and "Colonial" lamps. It has recently equipped and will soon occupy its new factory at Ravenna, Ohio. The notice of their removal to their new factory will be announced in a later issue. The company well deserves all the success it has attained as a manufacturer of high-grade incandescent lamps.

JOHN A. HAMBLIN, 12 Beverley street, Providence, R. I., is now placing on the market a new enclosed arc lamp which he claims to be very simple in construction and extremely long in life. The lamp has been put on the market after many experiments, and many improvements have been made over the old type of lamp which he formerly manufactured. This lamp, he states, though inexpensive is of very high efficiency and gives a steady white light. He has already received a large quantity of orders for the new lamp, the filling of which will keep him busy for some months to come.

THE BOSTON ELECTRIC HEATING AND POWER COMPANY, 153 Milk street, Boston, Mass., is interesting many street railway companies in its new electric blower system. In this system the heat is expelled from the heater by means of a rotary fan placed behind the resistance coil. The fan expels the heat and distributes it in all directions, giving an even temperature throughout the entire car or on the sides as desired. It is small, compact and handsome in appearance. One heater, the company claims, will thoroughly heat a 20-foot car. The volume of the heat may be regulated by a rheostat connected with the heater.

THE SPRAGUE ELECTRIC COMPANY, of New York, has recently opened a branch office in the Security Building, St. Louis. Mr. C. B. White, who is well known in the western electrical field, will have charge of the new office. He was formerly connected with the engineering department of the old Edison Electric Company, having been located in Pittsburgh, and having done considerable construction work in that territory. He was later electrical superintendent in charge of construction work with the Calumet Electric Street Railway Company, Chicago, and for the past two years has been connected with the Western Electric Company in the engineering and sales department. The Sprague Electric Company now has branch offices in Chicago, Boston and St. Louis, and agencies in all of the principal cities in this country and abroad.

THE CLARK AUTOMATIC SWITCHBOARD AND TELEPHONE COMPANY, of Providence, R. I., has about completed its tests on its new automatic switchboard. This switchboard, the company claims, will do away in a great measure with the necessity of a central station operator and will enable a party to make calls direct up to the number of 150 subscribers. It is especially adapted for interior telephone systems and hotel work, where telephones are installed in each room and calls made frequently to the office. By means of the Clark automatic switchboard the calls may be made from one room to another by merely turning the switch to the number of the room designated on the switchboard and ringing up that room. The company has already installed several of these systems which are working with excellent satisfaction.

THE COUCH & SEELEY COMPANY, 26 Binford street, Boston, Mass., are making some large installations of interior telephones. There was a time when the interior telephone was considered almost a luxury, but the development of telephone apparatus has so much increased during the past few years that it is considered by the large manufacturing companies a necessity for the prompt transaction of business. The company has recently moved into its large new factory, at which place it manufactures and assembles all of its well-known telephones. It occupies four floors of the large building on Binford street, which have been found to be not over sufficient for its rapidly growing business. The first floor is used for the offices and stock room of the company, as it intends to keep on hand a large amount of stock necessary for prompt fulfillment of orders. The offices are very tastefully fitted up and occupy nearly four times the space of the old offices. The second floor is used for the manufacture of switchboards and the smaller parts of telephone apparatus. The third floor is used for a sample room and every part is carefully tested and thoroughly tried before it is sent to the stock room. On the fourth floor is the machinery and plating department and a welding forge. In this way each telephone is constructed and assembled under the personal observation of Messrs. Couch & Seeley, and none with any defect is allowed to leave the workshop.